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The United States Red River Hydraulic Dredge Waterway

Early in the summer of this year the Dubuque Boat & Boiler Works, Dubuque, Ia., delivered to the United States Engineers at Vicksburg, Miss., the steel self-propelled hydraulic dredge *Waterway*, shown in Fig. 1. The dredge is a steel hull boat fitted with the ordinary type of stern-wheel towboat machinery, and a sand hydraulic pumping plant for river dredging. The dredging outfit also includes four steel pontoons and a pipe line, together with a full complement of auxiliary gear for handling the plant. The dimensions of the dredge itself are: Length between perpendiculars, 142 feet; beam, molded, 34 feet; depth, molded at center line, 7 feet; depth, molded at sides, 6 feet 8 inches; sheer, forward, 6 inches.

FIG. 1.—THE WATERWAY EN ROUTE FROM THE BUILDERS' WORKS TO VICKSBURG

The general arrangement and construction of the hull are shown in the accompanying illustrations, the main scantlings being indicated on the midship section.

The hull is framed transversely and stiffened by four transverse and two longitudinal watertight bulkheads, and by three longitudinal lattice trusses. The transverse bulkheads are worked intercostally between the longitudinal bulkheads and between them and the sides of the boat. The longitudinal bulkheads, on the other hand, are continuous from the bow plate to the main transom. They are placed 5 feet 8 inches on either side and are parallel to the boat's center line. The three longitudinal lattice trusses are also continuous and uniform from the bow to the stern, except where modified at the cockpit and boat ends, running in general parallel to the boat's center line. Each consists of a similar top and bottom chord and of lattice panels spaced 5 feet centers composed of the members shown in the framing plans, Fig. 3.

The hull has no overhanging guards, but at the stern there are on each side of the boat cylinder beams of I-section extending 48 feet 4½ inches in length and projecting 20 feet 3 inches aft of the false transom for the propelling engines. The after end of each cylinder beam is supported by a 1¾-inch diameter chain, the chain, or samsom posts, two in number, consisting of latticed columns which extend to a total height of 40 feet above the molded main deck.

At the bow of the boat is the hoisting frame for the suction ladder, which consists of an A-frame pin-connected to the bow plate with the legs spread 22 feet 8 inches between centers, each leg being constructed as a latticed channel column. The frame is guyed to the head of the swinging frame, which in turn consists of a 10-inch by 25-pound I-beam supported near each end from the main deck by a two-legged frame, each leg consisting of a latticed channel column.

The main deck of the dredge is given over to propelling and dredging machinery, but on the boiler deck, which extends from the stern forward a distance of 124 feet 6 inches, will be found two cabins with an open gangway, 10 feet 6 inches wide, separating them. The forward cabin is 30 feet 4 inches long by 26 feet wide, containing a central hall 11 feet wide with staterooms, bath and wash rooms adjoining it on either side. The forward end of the hull is used as an office and the after portion as an officers' messroom.

In the after cabin, which is 44 feet by 26 feet wide, are located the kitchen, the cook's and laundress' rooms, while the after part is taken up by the crew's messroom and quarters with a waiter's room on the starboard side and a laundry on the port side.

The hurricane deck, which is co-extensive with the boiler deck, contains only the pilot house, which is 12 feet by 11 feet 8 inches wide, located forward on the deck.

PROPELLING MACHINERY

Steam for the propelling and dredging machinery is furnished by two boilers of the Mississippi River type, each 42 inches minimum internal diameter by 28 feet long, with five 9¾-inch flues. The boiler shells and drums are 28/100 inch thick, the flues 25/100 inch thick and the heads ⅝ inch thick. All the longitudinal seams are double riveted and placed above the fire line, while the girth seams are single riveted. The flue type, 42 inches diameter, 8 feet high, containing eighty-five 2-inch tubes. This boiler furnishes steam for the deck machinery, engine room auxiliaries and electric light engine.

The main boiler feed pump is a horizontal duplex double-acting pump with steam cylinders 6 inches diameter and water plungers 4 inches diameter with a stroke of 6 inches. The auxiliary boiler feeder is a 7½-inch by 5-inch by 6-inch pump similar to the main boiler feed pump. It will also serve

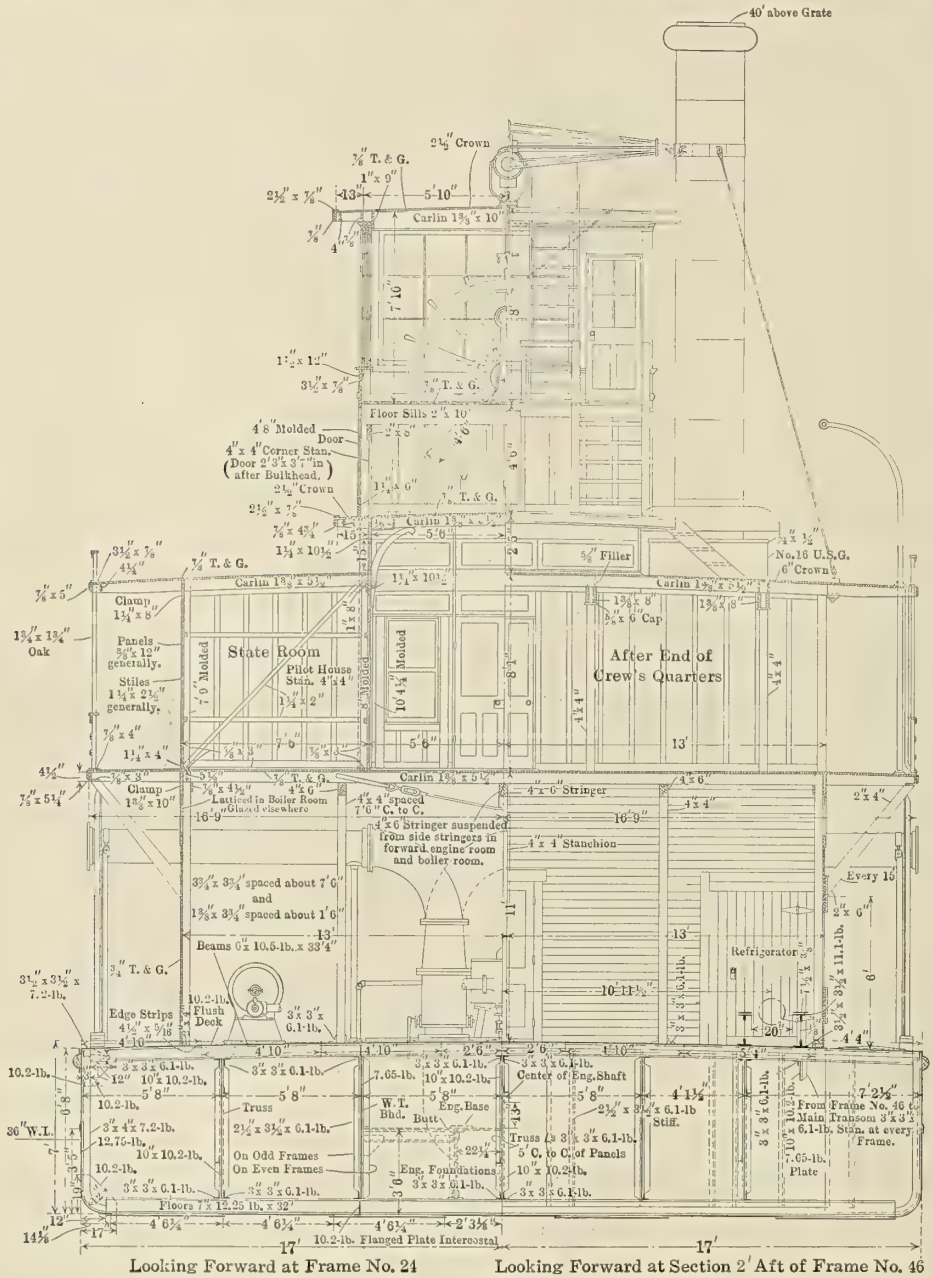
40' above Grate
State Room
Pilot House
After End of Crew's Quarters
Looking Forward at Frame No. 24
Looking Forward at Section 2' Aft of Frame No. 46

FIG. 2.— MIDSHIP SECTION

boilers are built for a working gage pressure of 160 pounds per square inch. The single steam drum, which is connected to each boiler by a leg 12 inches diameter, is 8 feet long by 18 inches diameter. There are two mud drums, each 14 inches diameter by 7 feet long, connected to each boiler by a leg 8 inches diameter. Each boiler is equipped with a Snowdon heater, and there is a mechanical draft apparatus for each chimney consisting of a 50-inch full-housed fan with water-cooled bearings guaranteed to deliver 5,000 cubic feet per minute of gases at 550 degrees Fahrenheit with a pressure of one inch of water.

There is also an auxiliary boiler of the vertical submerged as a general service pump for washing decks, pumping bilge, fire service, etc. There is also a full equipment of donkey, hand, deck and filter pumps with their connections.

The main propelling engines consist of a port and starboard cylinder each 13 inches diameter by 6-foot stroke of the usual Mississippi River type, with balanced poppet valves, both steam and exhaust, of the Frisbie type arranged for working full stroke, and also provided with a "California" or "Cross" cut-off adjustable from ⅛ to ⅞ stroke. Each pitman is 25 feet long from center to center of the wrist pins. It is of clear Douglas fir 13 inches deep and 11 inches wide finished dimensions at the mid-length.

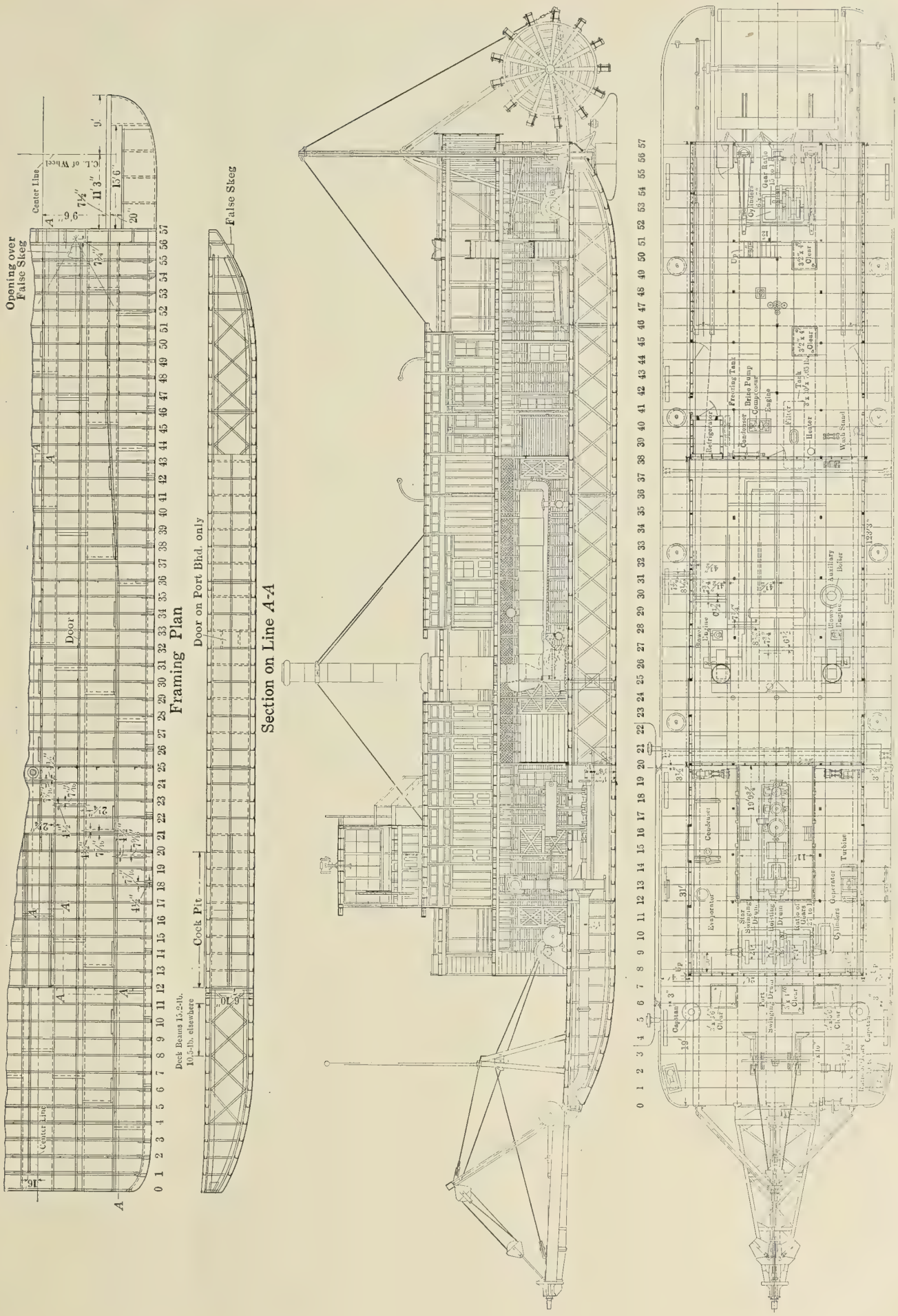

FIG. 3.—FRAMING AND GENERAL ARRANGEMENT PLANS OF THE DREDGE WATERWAY

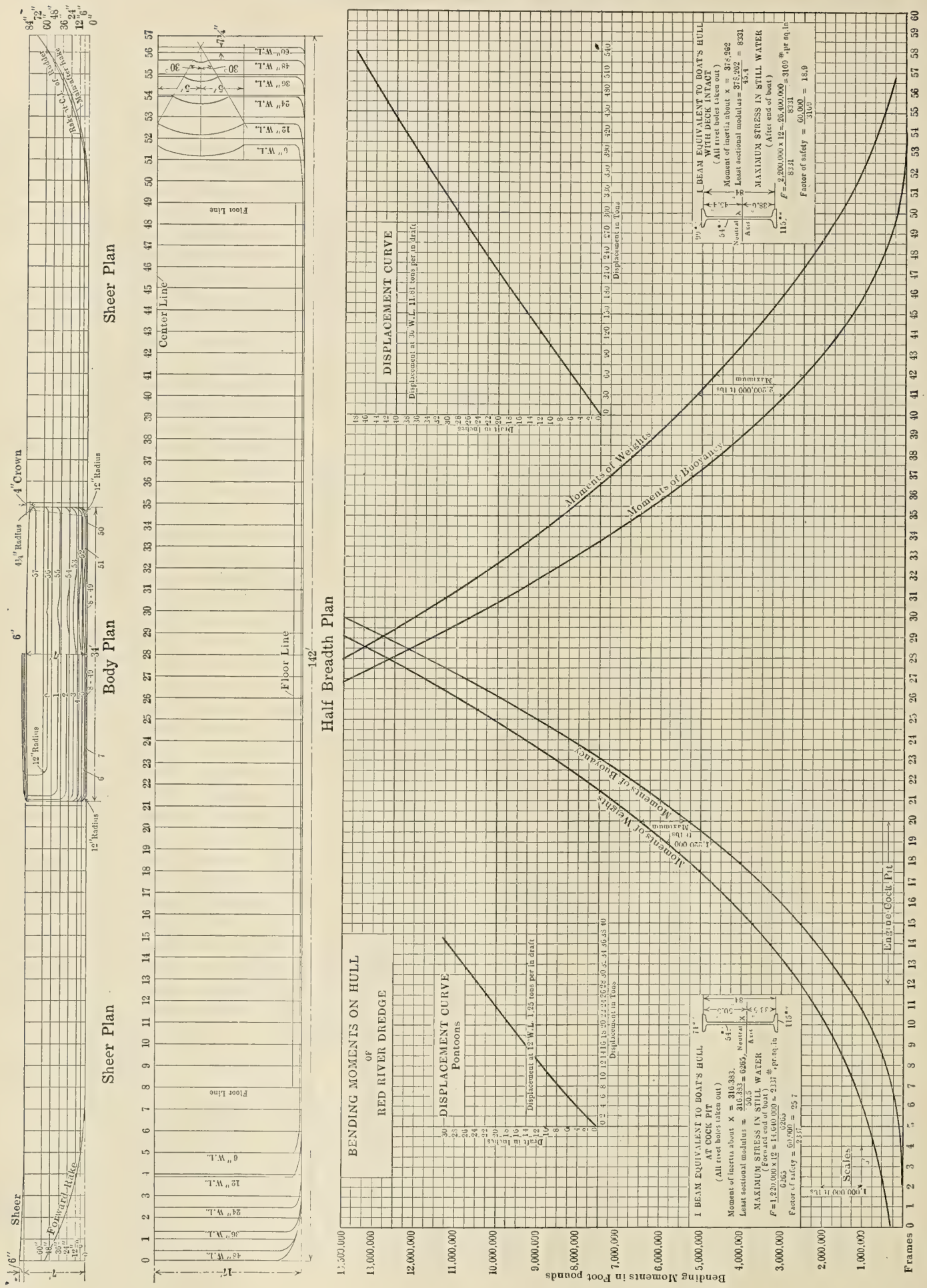
Sheer Plan
Body Plan
Sheer Plan
Half Breadth Plan
Sheer
Forward Rake
Center Line
Floor Line
4" Crown
12" Radius
DISPLACEMENT CURVE
Displacement at 30 W.L. 11.91 tons per in draft
Displacement in Tons
Draft in Inches
Moments of Weights
Moments of Buoyancy
Maximum 12,200,000 ft tons
BENDING MOMENTS ON HULL OF RED RIVER DREDGE
DISPLACEMENT CURVE Pontoons
Displacement at 12 W.L. 1.25 tons per in draft
I BEAM EQUIVALENT TO BOAT'S HULL AT COCK PIT
(All rivet holes taken out)
Moment of inertia about X = 316,333.
Least sectional modulus = 316,333 / 50.5 = 6265
MAXIMUM STRESS IN STILL WATER
(Forward end of boat)
F = 1,220,000 x 12 / 6265 = 2337 #per sq in
Factor of safety = 60,000 / 2337 = 25.7
I BEAM EQUIVALENT TO BOAT'S HULL WITH DECK INTACT
(All rivet holes taken out)
Moment of inertia about X = 316,262
Least sectional modulus = 316,262 / 49.4 = 8331
MAXIMUM STRESS IN STILL WATER
(After end of boat)
F = 2,200,000 x 12 / 8331 = 3169 #per sq in
Factor of safety = 60,000 / 3169 = 18.9
Engine Cock Pit
Scales
Bending Moments in Foot pounds
Frames

FIG. 4.—LINES AND BENDING MOMENT CURVES OF HULL

The stern paddle wheel is 18 feet diameter over the buckets. There are thirteen buckets, each 18 feet long by 22 inches wide by 1½ inches thick. Four of the buckets are double to balance the cranks. The wheel shaft is solid of hexagonal section with the diameter of the inscribed circle 9 inches.

A refrigerating plant of the ammonia compression type of sufficient capacity to cool a storage room or box of 150 cubic feet internal capacity, and, in addition, to make 300 pounds of ice per twenty-four hours, is located in the engine room. There is also an electric plant consisting of a direct-connected steam turbine and dynamo supplying current for one searchlight, three arc lights and one hundred incandescent lamps.

Dredging Machinery

The main pumping engine is located fore and aft on the center line of the boat in a cockpit in the forward engine room. It is of the marine type indicating 250 horsepower with steam at 160 pounds gage boiler pressure, 24 inches vacuum and 250 revolutions per minute. A steam separator is placed on the steam line to the main pumping engine and a vacuum oil separator is inserted in the exhaust line of the main pumping and propelling engines.

The dredging pump is of the centrifugal type with both suction and discharge 16 inches diameter. The pump is located in the engine cockpit transversely to the center line of the boat. Its intake is on the forward side, and its outlet, which is vertical of the rectangular form, is to the port of the boat's center line. A suction pipe, 16 inches inside diameter, extends on the center line of the boat from the suction pump forward, where it is connected by a radial joint to the suction pipe in the ladder. A reversing cutter engine with two cylinders 7 inches diameter by 10 inches stroke, is coupled at right angles to a common shaft and located on the main deck at the bow. The engine actuates the shaft and cutter head through a train of gearing to a ratio of about 18 revolutions of the engine to 1 of the cutter shaft.

The rest of the dredging machinery consists of a winch for hoisting the head of the suction ladder and for swinging the boat's head through the dredge cut; also a two-cylinder reversing spud hoisting engine. Three steel pontoons, 47 feet 6 inches by 12 feet wide and 3 feet deep, molded dimensions, together with another pontoon of slightly modified design and a complete discharge line, 16 inches diameter, fitted with flexible and sliding joints, complete the dredging equipment.

Twin Screw Shallow Draft Steamer

John I. Thornycroft & Company, Ltd., is building at the Woolston Works, Southampton, a twin-screw shallow draft passenger and cargo steamer of the following leading dimensions:

Length	180 feet.
Beam	27 feet.
Draft	3 feet.

The hull is built of steel, and divided into seven watertight compartments by means of six athwartship bulkheads. Ample space for cargo is provided in the hold, forward and abaft the machinery space, the passenger accommodation being provided on the upper and promenade decks.

The propelling machinery consists of two sets of triple-expansion engines driving tandem twin screws, the latter being housed in tunnels at the stern, this arrangement being adopted in order to reduce the draft to a minimum and to give the screws good protection in shallow water. Steam is provided by a watertube boiler placed in an enclosed stokehold, the boiler being worked under forced draft. The guaranteed speed is 15 knots.

THE NAPARIMA, A TYPICAL SHALLOW-DRAFT, SCREW-PROPELLED STEAMER

On the upper deck forward are four cabins suitable for the officers of the vessel, and on the same deck aft are placed the galley, dining saloon, lavatories, etc. On the promenade deck is a saloon for the passengers, a ladies' room, pantry and additional lavatories. The rudders are worked by a steering engine placed at the after end of the engine room, and controlled by a steering wheel fitted at the forward end of the awning deck.

Two 18-foot lifeboats are provided and slung from davits on each quarter, also four derricks are fitted for handling the cargo.

This vessel will proceed to her destination under her own steam. Temporary wooden bulkheads and a turtle deck are to be fitted in order to ensure her seaworthiness on this ocean trip.

In most respects the vessel is similar to the steamship *Naparima*, built by Messrs, Thornycroft for the same service some years ago, and which is shown in the illustration, but the present boat is considerably larger.

Boats propelled by gasoline (petrol) or petroleum are to be operated on the Moldau and Elbe Rivers to provide a service between Prague, Stechovic and other cities in Bohemia.

An American-Built Shallow Draft Boat for Alaskan Rivers

Situated at the mouth of the Copper River, Alaska, is what is known as the Orca Station of the Northwestern Fisheries Company, of Seattle, Wash. The cannery located at this station secures its principal supply of fish from the flats and shallow waters around the mouth of the river, and in order to transport the fish from the traps and seine boats where caught to the cannery it was necessary to provide a light draft vessel of considerable capacity for this work. Accordingly, plans for such a vessel were made under the directions of Mr. Frank Walker, marine surveyor and engineer, Seattle, Wash., and the contract for the construction of the boat was placed with the Hall Bros. Marine Railway & Shipbuilding Company, Eagle Harbor, Winslow, Wash. The boat is a stern-wheel steamer named the *W. H. Bancroft,* and has the following principal dimensions:

Length of hull, exclusive of wheel housings	111 feet.
Beam, molded	26 feet.
Depth, molded	5 feet 6 inches.

The hull is built of Puget Sound fir except the stem, which is of oak. The scantlings are shown on the drawings in Figs. 1 and 2. The framing, keelsons and general construction of the vessel are heavy, as she has to encounter bad weather around the mouth of the Copper River, where her route covers both open sea as well as river service.

The vessel has five rudders of the usual river boat type, the stocks of the rudders being 4-inch steel and the blades of ¾-inch plate. The combined area of the blades is large, and the rudders are controlled by a powerful hydraulic steering apparatus, since the swift river currents where the vessel plies necessitate quick hauling.

Cargo is carried in the hold abaft the boiler space and on the deck. The cargo space in the hold is ceiled tight and arranged for drainage to the bilge pumps. Deck cargo is carried to the height of the bulwarks as far aft as the engine space, the bulkhead at the forward end of the engine space being made watertight to the height of the bulwark rail, all doors opening to the engine room being entirely above this height. The galley is located at the after end of the engine space, and all living quarters are provided on the cabin deck.

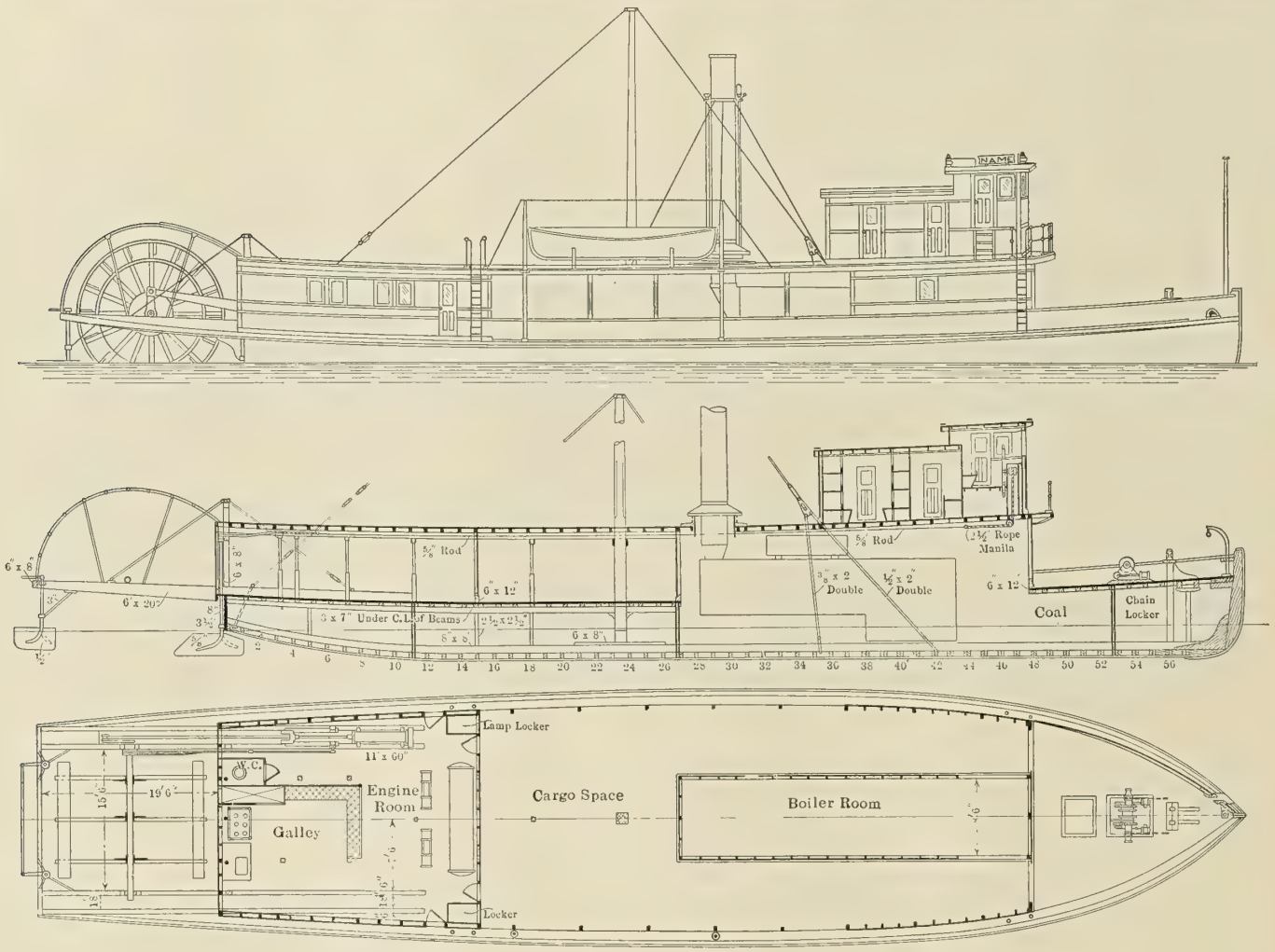

FIG. 1.—OUTBOARD PROFILE, LONGITUDINAL SECTION AND DECK PLAN OF THE W. H. BANCROFT

The vessel is propelled by a stern wheel 16 feet 6 inches diameter and 13 feet wide, having sixteen paddles. The main engines have cylinders 11 inches diameter and 60 inches stroke. Steam is exhausted through an independent condenser mounted on a Davidson compound circulating and air pump, which is located on the main deck between the engines. The condenser itself contains 760 square feet of cooling surface. Steam is supplied at a pressure of 200 pounds per square inch from a single boiler of the locomotive type, having a heating surface of 1,836 square feet and a grate area of 54 square feet,

making a ratio of heating surface to grate area of 32.8 to 1. The fire-room has an ash chute provided with an opening through the bottom of the boat for dumping ashes. The bunker capacity is 15 tons of coal, which gives the boat a steaming radius of 96 hours. The main steam pipe is of copper, 4 inches in diameter from the boiler to the engine room, where it is divided into two branches, each 3 inches diameter, leading to the engines. Two fresh-water tanks, with a combined capacity of 2,400 gallons, are located between bulkheads in the after hold.

The draft of this vessel at launching with the machinery on board was 18 inches. The load draft, with a maximum cargo of 125 tons of fish and with the bunkers full of coal, is 4 feet.

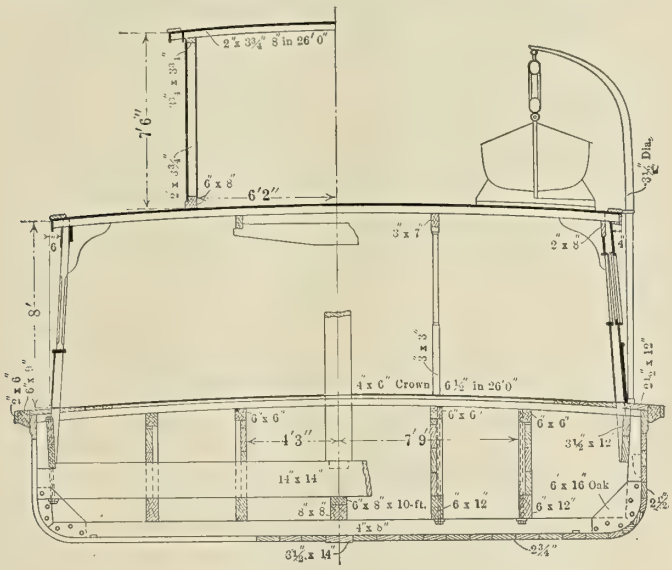

FIG. 2.— MIDSHIP SECTION

The vessel cost complete and ready for service approximately $33,000 (£6,800), and is a staunch and well-built craft throughout. The average speed when light is 10 miles per hour, and when loaded 6 miles per hour.

Another Signal Success for Towing Machines.—The tug Reliance, of the Isthmian Canal Commission (formerly the *M. E. Scully*), completed recently a most remarkable trip. With three barges in tow she left Cristobal on the morning of Feb. 11, and arrived in Panama Bay June 17, via the Straits of Magellan. One hundred and twenty-six days were occupied by the voyage of 10,500 miles. The number of actual steaming days was eighty-six. From Para to Pernambuco, a distance of 1,100 miles, the time was nine days and five hours. The severest weather was encountered during the first three days out, and the heavy seas kept the decks awash. The towing machine at the stern of the tug was often submerged while the bow of the vessel was high in the air. This tug is fitted with a No. 3 Providence Steam Towing Machine of the Shaw & Spiegle pattern, having double cylinders 14 inches in diameter by 14 inches stroke, and using 1,200 feet of 1¾-inch diameter steel wire hawser. Instances have been noted from time to time of steamers taking a single barge in tow from New York to San Francisco, and *vice versa,* and from New York to Liverpool, but this is the first time, we believe, that a tug has ever attempted such a triple tow. It demonstrates the great advantage to be derived from using a towing machine, which relieves the sudden shocks and strains on the hawser so as to prevent the parting of the same, and to enable the tug to proceed in any weather, where it would not be possible to do so were the tow handled in the usual manner, with the manilla hawser and solid tow-posts.

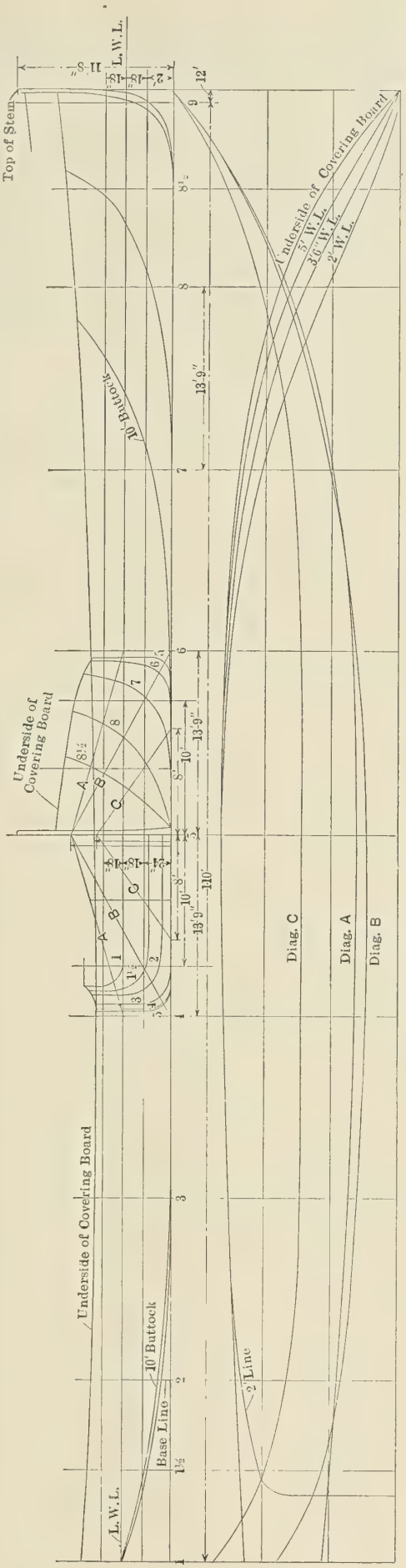

FIG. 3.—SHEER, HALF BREADTH AND BODY PLANS OF THE W. H. BANCROFT

Why Steamboat Traffic Declined Before the Railway*

BY PAUL W. BROWN

The completion of the Northern Pacific and the decline of the steamboat trade on the upper Missouri decided the last great campaign in the contest between the American railway and the American river steamer as means of transportation. What has come to pass since that day has been but a realization of a foregone conclusion. The trade on the lower Mississippi yielded to the inevitable much earlier; its "peak" was touched just at the end of the '50's; it never recovered the disorganization of the Civil War. The decade ending with 1880 saw a heavy traffic on the upper Mississippi; the lumber trade was brisk, and the rush to the Red River wheat country caused the upstream boats to draw deep. The Missouri, with its 2,084 miles of navigable channel, leading to the very gates of the Rocky Mountains, was the last stronghold of river transportation.

Though more than a score of years have passed since the issue was definitely decided, with momentous consequences in the realms of social development, economic progress, finance and even government, no adequate explanation of the victory of the railway over the river carrier has yet appeared. The course of events has been deemed too simple to require extended explanation. Champions of inland waterway navigation and writers on railway development, in polar antagonism on many points, have tacitly agreed that the reason for the decline of river traffic lay on the surface of the event.

When they have proceeded to state that reason, however, they have been far from saying the same thing. There are two standardized explanations of the passing of the steamboat trade, and each is made, with scarce a change of a phrase, many times a year.

The steamboat man and the waterway enthusiast—who, by the way, are not necessarily the same person—assert that it was the total depravity of railway managers which killed the steamboat trade. This is alleged as a sole and sufficient explanation. Steamboat traffic is of necessity limited to certain routes. Railways, we are told, were for years content to do business at a loss on those routes, and recoup themselves by overcharging in districts where there was no waterway competition, in order to strangle the steamboat trade. They gave rebates, issued passes, cut rates, bought up water terminals. They purchased boats, and either laid them up to rot, or made rates so high that no business fell to them. Their work was insidious. When the steamboat owners finally awoke to their danger, the railways were everywhere; their capitalization had reached a figure which made them preponderant in the world of finance; shippers were unable to take the large view, and saw only the free passes and immediate rate concessions held out to them, blind to the coming time when the railway should, like Poe's Red Death on the morning after the feast, "hold illimitable dominion over all." This is the steamboat view.

The railway man, on the other hand, declares that the passing of the steamboat was but the inevitable progress of an outworn instrument of transportation to the evolutional scrap heap. The steamboat season was limited; the railway runs twelve months every year. The steamboat schedule is broken by high water, low water, floating ice, storm; the railway is well-nigh as independent of weather as of season. An upstream freight carrier nets 5 miles an hour; a slow freight train nets 15. Steamboats are confined to certain routes, nearly always circuitous; railways may follow air lines in level country and surmount mountain ranges in that which is rough. Steamboats are restricted to waterside terminals in delivering freight; railway terminals may be as wide as the confines of the community served.

Each of these explanations wins its victory too easily; both are characterized by what John J. Ingalls called "the fatal gift of facility." Waterway explainer and railway explainer have shirked the laborious task of finding out why the steamboat passed away before the railway advance; each has told how the change ought to have occurred.

Now, history manufactured by "the rule of reason" is the least trustworthy commodity known to the commerce of ideas. Actual situations are always more complex than our thoughts about them. Leaving altogether at one side the question why the steamboat ought to have yielded to the railway, why, in fact, did it yield?

The moment we begin to scrutinize the two standardized explanations we are afflicted with certain doubts. The steamboat man's explanation may apply to the final phases of the struggle, but it seems wholly insufficient to account for the railway's initial victories. When the railway first appeared upon the scene, it was the interloper, the untried and unproven instrumentality, while the steamboat held the field. Throughout the river valleys of the West the steamboat interests controlled transportation, and were inextricably interlocked with banking and manufacturing interests. As for total depravity, manifesting itself in rate-cutting and kindred practices, by what Machiavellian stroke did the infant railways possess themselves of all the effective resources of human rascality, and leave the steamboat owners to go to hopeless ruin with clean hands and pure hearts? No explanation of this miracle has ever been tendered, nor am I aware of anything in the history of morals which might help one to understand it.

When we turn to the railway explanation we feel the same dissatisfaction. It is true that the river carrier does not operate throughout the whole year; but the same disability has not prevented the lake carrier from building up a traffic which is one of the wonders of modern transportation. The railway may, within certain broad limits, go where it pleases and deliver goods where they are desired; but the infant railway competed for business in a world organized for steamboat traffic, with waterside warehouses and factories. Steamboats are much slower than fast freight trains, but in the years of the railway's initial victories over the steamboat our modern high-pressure system of distribution had not been organized, and was not even dreamed of. Shoes were made by hand; packing-house products were unknown outside of a few large centers; harness, wagons, buggies were made in small shops in every village; bananas and oranges were unfamiliar delicacies to the average American. We cannot account for the early triumphs of the railway by invoking its supply of needs which had not then been created.

When we consider the main contention of the railway view—that the steamboat was brushed aside before a more economical means of transportation—we are confronted by the incontestable fact that it has not been brushed aside. Small as is the volume of steamboat traffic, it still continues, and not simply with districts not readily accessible by rail, like the projecting tongue of land between the Mississippi and Illinois. The steamboat survives in highly competitive territory. St. Louis and Alton are connected by railways and by a fast interurban trolley line; yet packet boats, carrying both freight and passengers, carry on a trade which flourishes in the teeth of

* From the Railway Age Gazette.

this double competition. The Lee Line runs steamers between Memphis and St. Louis, Memphis and Vicksburg, and Memphis and Cincinnati, in competition with great railway systems operating through a country whose climate and topography are especially favorable for economical railway operation. The single instance of this company, with its record of continuous operation for more than a generation between chief commercial centers of the central west, is proof conclusive that the explanation of the passing of the steamboat must be sought in something more convincing than an easy generalization about "an outworn instrument of transportation."

The full explanation is not all to be found in any one place. The portions of it which I have gathered have been encountered in many places; in conversations with old merchants in little waterside towns, and with old pilots on hills overlooking long reaches of empty river; in stray remarks dropped in pilot-houses, as a laden packet went swinging down the long curve under the high bank of a great bend on a summer night; from dusty files of newspapers of the '50's; out of observation of the actual operation of steamboats on many waters at the present day. The main factors of the decline of the steamboat trade in the face of railway advance were:

Instability of rates.

Uncertainty and irregularity of service other than those occasioned by the shortness and variable length of the river season and the ordinary hazards of navigation.

The short life of the individual steamboat.

The nuisance of marine insurance.

The lack of effective line organization.

The habit of extravagance engendered by an era in which the westward advance of population was out of all proportion to the capacity of existing means of transportation.

The first two points—instability of rates and irregularity of service other than that inseparable from the conditions of steamboat operation—are so intimately related that they may most conveniently be considered together.

In the golden days of steamboating there was not a stable rate in all the vast region lying between Fort Benton, Mont., and Pittsburgh, Pa. Each steamboat was an independent traffic unit; the captain was his own freight and passenger association, classification committee, and general passenger and freight agent. In New Orleans in the greatest year river trade ever saw—the season ending August 31, 1860—the average cargo of the 4,030 steamboats tieing up at the levee was 540 tons; at St. Louis, eighteen years before, the average cargo of the 2,412 arrivals was 193 tons. It is not too much to say that there were as many "adjustments" of rates as there were arrivals, for while occasionally two or three boats might load side by side at identical rates, more often the captain of a steamboat that was loading found it either necessary to "shade" his figures to complete his cargo, or possibly to raise them as the available stowage space grew smaller, in view of an empty river and a full wharf.

A single instance will mirror the situation. Missouri City, on the north bank of the Missouri River, 28 miles below Kansas City, was once an important shipping point for a wide hinterland. "When boats were plenty at the season of high water," said an old shipping merchant, "the St. Louis rate would go down to 25 cents (1s. ½d.); when the low water season came on and boats were scarce, it sometimes reached $2.50 (10s. 5d.). Passenger rates varied from $10 to $25 (£2 1s. 8d. to £5 4s. 2d.) for the same reason."

An incident of those days rounds out the picture. "I remember," said the Old Timer, "once Jim Lane sold some tobacco to the government. The water was low, and Jim was mighty anxious to get it started towards Fort Leavenworth. Well, the *Annie Jacobs,* Captain Bill Massie, come along, loaded so's she was drawin' all the water they was in the river, but pretty well down by the head, so if she got her nose over a bar, the rest'd be pretty sure to follow. 'Take my tobacco?' says Jim. 'Not on yer life,' says Bill Massie. Jim begged and begged, but 'twa'n't no use. Finally he says: 'Cap,' says he, 'if you'll jest put that tobacco aboard, and start her up river, I'll pay ye the full rate, and give ye the best suit o' clothes that a $100 bill 'll buy in St. Louis.' So Bill he took the tobacco." It is needless to remind the reader either that the Elkins law slumbered in the bosom of the unrevealed future at this time, or that interesting statute has never been construed to apply to steamboats.

Late in November, 1852, just at the end of the season, the *Excelsior* arrived in St. Paul from St. Louis with 300 tons of freight for which she had received "one dollar (4s. 2d.) a hundred any distance."

Coupled with fluctuations in rates which mounted to 1,000 percent of the minimum there was great irregularity of service, owing to the fact that the individual steamboat did not, for the most part, develop a trade and stick to it, but went where the returns were greatest. The Western "steamboat country" extended from St. Paul to the Gulf, and from the heart of the Southern Appalachians and the headwaters of the Allegheny to the foothills of the Rockies in Montana. Times might be dull on the Tennessee and good on the Oauchita; the Minnesota river trade might boom just at the time when crops had failed on the Osage and the Gasconade. What happened then? A steamboat which had made regular trips to certain landings for two or three seasons might enter trade simply by hiring a new pilot, or instructing the old one, if his license covered the new territory, to turn the boat's head in that direction. The freight at the old landings would wait in vain; it might rot, or find some other conveyance. Nothing bound the vagrant steamer to her old trade, as the sound of her deep breathing grew fainter in the distance, and the white water from her paddles blended indistinguishably with the turbid river. This tendency of the steamboat, without warning to the shipper, to deprive him of his accustomed means of transportation just at the season of his greatest need—the time of crop failure, or of slow transit, because of low water—was one of the prime uncertainties of business "when the steamboat was king." Trade can adjust itself to a limited shipping season; the hazards of high and low water follow, usually, a certain cycle, and may be in a general way foreseen. But the steamboat that departed for more crowded landings just at the time when an established trade most needed regular service, introduced into business a hazard of the first order.

What was the effect of these fluctuations in rates and uncertainties of service on the competition of rail transit with the river trade?

While there are, of course, factors making for variability in rail rates, they are few and feeble compared with those which influenced river rates in the olden days. The river is an open highway; any man who could command $20,000 (£4,110) could build and pay for a small sternwheel boat and become a factor in rate making; the railway is an artificial traffic way and requires a heavy initial investment before equipment is purchased and operations begin. The costs of river transportation as carried on in the '50's were only interest on cost of equipment, depreciation of equipment, wharfage charges, fuel and boat supplies, and wages of crew. To run a railway requires a large and permanent organization—engineers, section men, bridge men, station agents, despatchers and signal men, yard and roundhouse crews, a traffic staff, etc.—in addition to the crews operating the trains. All this fixed expense tended inevitably toward stability of rates. Then, too, the climatic factor, while affecting the railways to some extent, is negligible in rate making. Times of high water may cause

an occasional washout on a railway, but that is all; while the season of low water does not exist for railway operation. A railway knows delay on account of storms, but it is but an incident of the day's work. In the steamboat trade, on the other hand, low water greatly increases operating expense, while high water makes certain landings inaccessible, and opens up some areas of traffic which are closed at ordinary stages. All these are real and vital factors in the making of rates.

Still another thing must be taken into consideration: the size of the unit of equipment. A railway train is elastic, and is an aggregation of traffic units containing, in the early days, about 8 or 10 tons each. The steamboat with which they competed had a fixed capacity averaging as much as two 20-car railway trains. Full or empty, the downstream expense was practically the same, and the upstream cost nearly so. After a boat had secured cargo enough to meet her fixed and operating expenses, all that came to her in addition, at any rate greater than the expense of setting it on and off, was so much clear gain. If the freight trains of that day had a fixed length of 20 cars, railway rates would have had an additional element of instability.

But in the matter of service, the great advantage of the railway over the steamboat was that the grade was not portable and the rails spiked down. The railway stayed when the steamboat went—not because the railway man was wiser than the steamboat man, not because he would not have been glad to move his road, when times were dull at home, to lead into the Red River Valley, or to the mines of Montana, but simply because it couldn't get away. Before long, the railway man began to see his opportunity in the steamboat man's desertion of his territory. *The railway intrenched itself as an instrument of transportation in the lean years, when the steamboat had departed for other valleys, where the hills were green afar off.*

Now it is an axiom of the transportation business that any rate is better than an uncertain rate. When this is reinforced by the further axiom that a certain means of transportation has an infinite advantage over an uncertain one, it will be understood why the shipper "signed up" with the station agent after the steamboat had left his goods, literally high and dry, in his hour of need, and paid a somewhat higher rate for a definite service. The shipper was willing to wait for the *Prairie Belle* when the river was low, and to lay in a stock in the fall to "run him through" till spring; but when the captain of the *Belle* left the Illinois river to go to the Yellowstone without sending him word, and he let the *Evening Star* go by because he was saving his apples for the other boat, thus losing a dollar a barrel in the St. Louis market, he vowed vengeance, and went in quest of the railway station agent.

The life of the wooden steamboat is short. The *Western Boatman* for 1848 presented an estimate of the total number of steamboat "fatalities" up to that time, with an analysis of causes. The conclusion was that the average age of boats "worn out or abandoned" was five years, and that of those "sunk, burnt or otherwise lost" was "four years, or nearly four." In the ten years between 1840 and 1850 there were 270 boats lost in Western waters. Forty boats lost their lives by snags in 1840, according to Gould's "History of River Navigation," and 29 in the year following. George B. Merrick, the historian of steamboating on the upper Mississippi, has compiled records, as far as possible, of every boat which ever ran regularly above the Upper (Rock Island) Rapids. Their average life was five years. The most prosperous year on the Lower River, 1860, saw 290 boats destroyed or damaged; 120 of these were totally destroyed.

It is interesting to compare these figures with the number of steamboat arrivals at New Orleans, the great entrepôt of the valley. These totaled 4,030. The casualty list, of course, includes all Western waters, but it is suggestive that if the boats reaching New Orleans averaged but ten trips each in the season—which is twelve months long on the Lower River—the fleet numbered but 403; and that the number of casualties in the Valley resulting in total loss was about one-third as great as the whole New Orleans fleet.

The average life of the boats worn out in service seems very short. We shall return to that point later. It should be remembered here that average means average. There were boats which remained in service for twenty years, like the *Itasca,* built in 1857 and burned at La Crosse in 1878; but there were others which never completed the first trip.

Now, the short life of the steamboat had a very definite influence in its contest with the railway, entirely apart from the question of hazard. A railway is, physically, a resistant thing, and a dull season perhaps has as great a tendency to lengthen the life of rails and equipment as to shorten it. But the causes which operated to produce a dull year in the steamboat trade—crop failure and consequent paralysis of business—brought about also a stage of water that greatly increased the hazards of operating wooden boats. Then, too, it must be remembered that the prosperous boat owner who became a trifle lazy and stopped building boats, though he might continue to operate all he had, would, in the course of a very few years, go out of the business automatically. A railway, short of bankrupt sale, remains, for better or for worse, in the hands of its owners; a fleet of wooden steamboats, no matter how well operated, if not reinforced by frequent additions, literally disappears from sight in the course of a few years and "leaves not a wrack behind."

The nuisance of marine insurance was a factor in the decline of the steamboat trade which may be summarily disposed of. For some inscrutable reason, steamboat men have never learned to deal with the insurance brokers themselves, and issue an insured bill of lading. After the shipper has obtained a satisfactory rate, he must visit the broker himself, and get his insurance. Nor is the insurance full; it covers only damage in transit; goods at the landing are at the shippers' risk. Even though freight rate and insurance rate added together leave a comfortable margin below the rail rate, there are the human factors of worry and trouble, and the commercial factor of time lost over negotiations.

Before we begin to consider the effect on the steamboat trade of absence of adequate line organization, I wish to revert to the important fact that the victory over the steamboat was won, not by the railway of the present day, but by the railway as it was in the Mississippi Valley between 1860 and 1880. When the steamboat man of the present day talks of the change that has come over his calling, he accounts for it by experiences of the past twenty-five years, the darkening twilight period since the setting of the steamboat sun. When the railway man of the present day pauses to account for railway supremacy, he unconsciously thinks in terms of the modern railway. Now, let us recognize, once for all, that the railway that won a victory over the steamboat knew nothing of continuous brakes on freight trains; that its freight cars carried from 16,000 to 28,000 pounds each, instead of from 60,000 to 110,000; that 38 tons was, in the Mississippi Valley, a heavy locomotive; that rails were largely of iron, perhaps 40 pounds in weight on the average; that block signals, gravity terminals, automatic couplers, steel underframing and draft rig were as far from the vision of the railway man as were concrete bridges and culverts, 100-pound rails, ½ percent grades through rough country, compound engines and superheated steam. The steamboat of fifty years ago was every bit as good as the steamboat of the present day; the record time between New Orleans and St. Louis was

probably made by the *J. M. White* in 1844 (the *Robert E. Lee*, in 1870, finished in less time than the *White*, but the river had materially shortened itself by cut-offs in the intervals). The railway has gone on; the steamboat has stood still.

It is very easy to draw the wrong inference from this fact. The hasty generalizer will jump to the conclusion that if the steamboat retired before railways so imperfect it is evidence of its utter worthlessness in the modern transportation world. Let me once more remind him of the boats now in operation in highly competitive territory, and advance, tentatively, the view that the conclusion to be drawn is rather that factors other than the straight economic test of two rival instruments of transportation are to be invoked in the explanation.

This is especially to be remembered when we take up the absence of adequate line organization, and its effect on the steamboat's fate.

The great magnitude of American commercial corporations, that most significant fact of our modern commercial life, with its marked effects on social organization and even on national character, is the direct result of necessities laid upon American railway managers by the continental sweep of American territory. The first big American corporation was the railway corporation, and it became big because of the breadth of its necessary field of operation. In England there is no town or village situated more than 90 miles from a seaport. In France the greatest distance from the seaboard is little more than twice as much. In the United States the goods which, at Buffalo, reach the eastern limit of Lake navigation after a journey of 1,000 miles, are still 400 miles from the seaboard. In 1843 the traveler could go by rail from Buffalo to Albany, but he was carried on the rails of sixteen different companies. The business was largely through business. It traversed a territory under one government, with one language, one law and one tradition. That these sixteen companies, each by a link in one haul, should coalesce and become one was inevitable. It was but response to the compulsion of inexorable necessity.

All over the United States the same process was going on. The world had never seen such corporations. Mankind had never extended so far the bounds of a single commercial management. But the continent was inexorable. It was the continent that compelled the American railway manager to stretch his conceptions to its imperial extent, to think in terms of its vastness, to run one railway from the sea to the Lakes, and from the central river to the western sea. The early railway managers made mistakes. They tried to apply to corporations gigantic beyond precedent means of control inadequate to such vast creations. Some of them were devoured by their own Frankensteins. But the length of the railway was dictated by necessity. The road had to run to the land's end.

The steamboat man saw this, and tried to meet combination with combination. He failed. The reason is clear. He was not coerced by necessity. Between St. Louis and New Orleans one captain and crew, with a $40,000 (£8,220) boat, was as complete an instrument of transportation as the Illinois Central Railroad—of far less capacity, but equally sufficient unto itself.

The human factor is tremendously important here. The steamboat, in 1860, had been the chief means of transportation in the West for forty years. It was then as old as the railway was in 1894, forty years after the first line touched the Mississippi. The best human material had gone into the business. Now, the steamboat man was an individual pure and simple. The captain made his own schedule, selected his own route, accepted or rejected freight consignments, as his judgment dictated. He often owned his own boat; how often one must pore over old steamboat lists to realize. If he worked for other owners, they trusted him in everything, so long as the returns of the trade were satisfactory. He penetrated new countries. He braved hostile Indians. At each end of the season, in the North, his boat played a game with death as he dared the ice, for there were rich rewards for the last boat into St. Paul, and the first to leave St. Louis or Dunleigh (East Dubuque) in the spring.

One thing this admirable and capable individual did not understand—how to work in harness. This is the first lesson the railway teaches, for obvious reasons. It is, in the end, the great lesson of civilization's riper pages. The steamboat captain lived and died a pioneer. And when the transportation business reached the stage where organization on a large scale was a determining factor, the railway found itself with a personnel trained to pull together and move at the word of command, while the steamboat trade was manned by a splendid set of individual chieftains, undisciplinable, unorganizable, each ready to go down to the bottom of the river, if necessary, with his own particular pennant nailed to his own particular jackstaff.

The Rock Island tapped the Mississippi in 1854. Within two years thereafter the railway reached the river crossings at Galena, Alton, Burlington, Quincy and Cairo, and the railway became a factor in the steamboat world. The first joint stock company for the operation of steamboats in Western waters was the "Cincinnati and Louisville Mail Line," organized in 1818. The first regularly organized company in the Upper Mississippi was formed in 1842. It was not until just after the Civil War that this form of organization was tried out on the Missouri. Many of the so-called "lines" were simply operating pools. Each captain owned his own boat and could retire with his share of the profits or losses at any time. The instability of such an organization at just those times when organization was most vital to the life of the trade needs no comment.

A few brief biographies of lines, real and so-called, will reveal the actual course of events better than general statements. In 1858 the "Railroad Line," having traffic arrangements with the Illinois Central at Cairo, and the Ohio and Mississippi at St. Louis, was formed by the owners of ten of the finest steamers in Western waters to run between St. Louis and New Orleans. "While this was not a joint stock company, the boats were run in joint interest, and with a regularity heretofore unknown in this trade and at uniform prices for the business they did." The traffic man will read much between the lines of this naive comment of Captain Gould, vessel master and historian of steamboating. Soon the new line, which included the *Pennsylvania* and the *Alex. Scott*, was high in favor with shippers and passengers. "A position in the 'Railroad Line,' or a 'day in the line,' as it was called, was coveted by all who had a boat suitable for the trade, and commanded a large premium when offered for sale, and as high as $1,500 (£308) was paid in some instances." This line was broken up by the Civil War.

Just after the war, in the prostration following the destruction of southern trade and the disuse of army transports, a large joint stock company, the "Atlantic and Mississippi Steamship Company," was formed by steamboat owners, who took stock according to the appraised value of the boats they put into the line. The capital was $2,000,000 (£411,000). The line had through billing arrangements with railways and ocean-going lines. This venture was killed by the individualism of the steamboat men, both without the line and within it. The owners who were left out of the new organization combined at once and disorganized the rate situation by competition. The effects of this spirit within the line are eloquently summed up by Captain Gould. "Many of the steamboats were in commission, manned by crews with little [pecuniary] interest beyond their salaries, each crew striving to excel the

other in the excellence and luxury of their tables and the speed of their boats, with no one to control or check their extravagance.'"

A lurid light is cast upon the central organization of a corporation the aggregate of whose property was "fabulous" to the chronicler. "The widespreading limits of the company's business rendered it impossible for the executive officers (only two of whom were receiving salaries) to do more than give general supervision, leaving the detail and the result to the judgment and the caprice of those in charge of the boats." Discipline in the general sense there was none, and discipline on the individual boat appears to have gone by the board, for a series of disasters swept away half the fleet in six months. The line lasted less than two years. We read that "the directors were liberal, high-toned business men, and stood manfully by the company throughout all its embarrassments."

It is worth while to remark again that these were the best boats, officered by the best boatmen in the Valley. This single history is conclusive as to the fitness of the pioneer steamboatman to "work in harness."

All other forces making for the decline of the steamboat trade were intensified in destructive quality by the general social situation in the forty years intervening between 1850 and 1890. This was a time when a tremendous population movement overflowed utterly inadequate channels of transportation. All the steamboatman's other disabilities might have been overcome had he been in any true sense a sane business man.. He was the spoiled darling of fortune. The whole course of social development was such as to beget in him habits of extravagance, and to make him trust that the morrow would care for the things of itself. The steamboat, during the years between the building of the first railroad to the Mississippi and the completion of the Northern Pacific, which killed the trade between St. Louis and the Upper Missouri, was not, like the railways of the present day, the medium of the interchanges of a settled population. It was the vehicle of the advance of an eager population into a virgin land. The '40's and '50's saw the rush to Wisconsin and Minnesota; the period following the war witnessed the conquest of the Red River wheat country by immigrants by the Missouri and the Red River of the north. Then came the discovery of El Dorados on the headwaters of the Missouri, beyond the end of its 2,084-mile steamboat journey from St. Louis.

"Many a time during the Minnesota rush," said an old pilot to me, "the captain has watched the people coming on the boat at Dunleith or Rock Island until she had all she'd sleep on the cabin floor and the boiler deck, besides two in every bunk and steerage passengers all over the freight on the main deck. When he guessed she had all she'd take, he and I would take the sounding pole and walk down the landing-stage, crowding back the people who were pouring on in a steady stream. Then we'd cast off and straighten up, with the levee as crowded, to the eye, as when we come in."

It was the demand for transportation thus created—and the incident given above could be paralleled many times in every "trade" of that day—that was at the root of all the steamboat's disabilities. It was responsible for the fantastic variations in rates; it was responsible for the desertion of established routes by captains, lured by the great rewards of pioneering. The short life of the steamboat would have lengthened, as improvements strengthened its weak places, substituted steel for wood, and differentiated passenger and freight carriers, just as has happened in Europe; but what was the use? When a good boat would pay for herself in one season and could reasonably be expected to last five, why worry over steel hulls and cargo-box barges? Suppose the shipper did find himself incommoded by the necessity of bargaining with the insurance broker; who cared, when there was more freight as it was than the boat could load? Suppose the line went to pieces; the captain of the *Nancy Belle* held a license covering the Missouri, and passengers were plenty at St. Louis with $300 (£62) each to pay for transportation to Fort Benton. Pilots were paid regularly $500 (£103) a month; crack men received much more. One pilot, paid by the trip, who had an especially good knowledge of the eccentricities of the Missouri, made $120 (£25) a day between Kansas City and Omaha. Captain "Bill" Massie "cleaned up" more than $30,000 (£6,160) in a single season on the Missouri at the wheel.

When the West and North became populated this transportation fever went down. It left the steamboatman with an empty pocketbook—for his prodigality had equaled his earning power—expensive tastes and invincible prejudices in favor of the business methods of a boom period.

The foregoing were, in my opinion, the chief causes of the decline of the river trade in the West. The causes usually alleged by critics of the railways certainly operated and go far to explain how the rail lines, grown strong and conscious of their strength, took away the remnant of the kingdom of the steamboat. But this is not the real problem; that is set for us by the earlier years, when the railway was crude and its service imperfect, when accidents were many and schedules represented only the substance of things hoped for, while the steamboat was the accepted means of transportation in a traffic world organized by and for water carriage. The victory of the railway was not a matter either of swiftness of transit or ton-mile costs. The question of the relative economy of the two instruments of transportation in the Mississippi Valley has yet to be tried out in a practical way.

Naval Architects' Meeting

The twentieth general meeting of the Society of Naval Architects and Marine Engineers will be held in the Engineering Societies building, New York, Thursday and Friday, Nov. 21 and 22, each session beginning at 10 A. M. The Council will meet at 3 o'clock Wednesday, Nov. 20, in the Engineering Societies building, and proposals for membership should be mailed so as to reach the secretary on or before that date. The annual banquet will be held in the Astor Gallery of the Waldorf-Astoria at 7 P. M., Friday, Nov. 22.

A preliminary list of papers to be read at this meeting is as follows:

November 21

1. "Experiments on the Fulton," by Professor C. H. Peabody, Member of Council.
2. "The Design and New Construction Division of the Bureau of Construction and Repair, Navy Department," by Naval Constructor R. H. Robinson, U. S. N. Member.
3. "Engineering Progress in the U. S. Navy," by Captain G. W. Dyson, U. S. N.
4. "Marine Lighting Equipment of the Panama Canal," by Mr. James Pattison.
5. "The Lightship," by Mr. George C. Cook.
6. "Oil-fired Marine Boilers," by Mr. E. H. Peabody, Member.
7. "The Preservation of the Metals Used in Marine Construction," by Lieut. Commander Frank Lyon, U. S. N.

November 22

8. "An Electrically Propelled Fireproof Passenger Steamer," by Mr. W. T. Donnelly and Mr. G. A. Orrok, Members.
9. "Notes on Fuel Economy as Influenced by Ship Design," by E. H. Rigg, Member.
10. "Different Applications of the Marine Gyro in Science," by Mr. Elmer A. Sperry, Member.
11. "Rudder Trials of the U. S. S. Sterett," by Asst. Naval Constructors R. T. Hanson, U. S. N., and J. C. Hunsaker, U. S. N., Juniors.
12. "Logarithmic Speed Power Diagram," by Mr. Thomas M. Gunn.

Papers are also contemplated on "Recent Developments of the Marine Diesel Engine" and the "Development of the Hydro-Aeroplane," subjects which are of particular importance at the present time, and which it is hoped will be thoroughly discussed at this meeting.

Water Transportation, Rail Rates and the Inter-State Commerce Commission

BY JOHN RUDDLE*

The great agitation that has taken place within the last few years and the great expenditure of money that has been made by the Federal Government on improving waterways for navigation, warrants the assumption that it is the policy of the United States to encourage the development of internal water-borne commerce—whether for the purpose of assisting in the regulation of railroad rates or for the sake of the water traffic itself is aside from the question—the policy seems to be established. But in all the discussion the method of regulating the competition between the water carriers and the railroads seems to have been overlooked, or at least has received very little discussion.

In European countries it was discovered very early in the development of railroads that it would be necessary to protect the commerce carried by water from destructive competition from them or it would be destroyed. It was comparatively easy to establish this protection and to make it effective, because the railroads and waterways are very largely owned by the governments, and all that was necessary was to establish rules in making rates that the rate by the railroad should be higher than by water, and they could be easily enforced. Moreover, the public had long been accustomed to transportation by water, and had located their industries so that advantage could be taken of it, and they were naturally very much opposed to having these industries interfered with or made less profitable by the railroads making more favorable rates to the industries that were not so located or could not be reached by waterways; consequently they looked with favor on a differential in favor of the waterways, and it was easy to establish and enforce.

It would be impossible, and even if possible it would be very undesirable, for the United States to follow in the footsteps of the European countries, in order to build up water transportation and fix any arbitrary differential between the rates for water and for rail transportation. In the United States, however, the conditions are radically different. Here the railroad development came first over a very large portion of the country, and industries are located with reference to transportation by them, the water transportation is only now following. Moreover, the railroads are all owned by private capital, and the savings of the people are very largely invested in their securities. Up to the time the Inter-State Commerce Law was made effective the railroads had it in their power to make such rates as pleased their managements, and when in competition for business carried by waterways frequently made rates sufficiently low enough to take all the business away from them and destroy them, and after their destruction raised the rates again not only to the old figure but sufficiently above to recoup themselves for the losses incurred in destroying the water competition. The Inter-State Commerce Law puts in the power of the Commission to regulate the railroad rates and to protect the water traffic from this destructive competition; but, unfortunately, it has not always been so administered, and the water traffic is little, if any, better off than it was before the passage of the law.

As is well known, Section 4 of this act contains a provision known as the "long and short haul clause," which provides "That it shall be unlawful for any common carrier subject to the provisions of this act to charge or receive any greater compensation in the aggregate for the transportation of passengers or a like kind of property, *under substantially similar circumstances and conditions*, for a shorter than for a longer distance over the same line." * * * "Provided, however, that upon application to the Commission" * * * "such common carrier may, in special cases, after investigation by the Commission, be authorized to charge less for the longer than for the shorter distances." The railroads have taken advantage of the phrase "substantially similar circumstances and conditions" to claim the right, under the provision, to make low rates to meet the water competition existing or potential, and their contention has been recognized by the Commission, and the right to make lower rates for the longer than for the shorter haul has been granted. Some of these rates thus made have been unprofitable, and usually, if the water competition was destroyed, the rates were put back to what they originally were or higher. Also the railroads, in order to recoup themselves for the losses incurred under the low rates, made and maintained unduly high rates between points that could not be reached by water transportation, thus placing such points at a disadvantage.

An effort has been made by a recent amendment to the act to prevent the railroads from increasing their rates after they had once been lowered to meet water competition, unless some reason other than the disappearance of such water transportation shall be shown. This, however, is no protection to the water transportation; in fact, it only serves to make more certain that it will not be revived. The application of the law first destroys the water competition and then makes sure that it will stay destroyed by preventing the railroads from increasing their rates to such a point that water transportation would again become profitable.

The following principles of economics will probably be admitted:

1. The body politic has a right to receive from its servants satisfactory service at the lowest cost consistent with such service, all things being considered.

2. If one portion of the body politic receives a service at a cost lower than the actual cost of performing such service some other portion must be charged a higher rate for its service in order to make up the deficiency.

3. No portion of the body politic has a right to receive a service at a cost lower than the actual cost of performing such service.

4. If water transportation cannot perform satisfactory service at a rate equal to or less than the cost to the railroads, it is not entitled to special protection, for the body politic cannot, in the long run, support uneconomical servants.

Specifically, if a railroad makes a rate for transportation at less than the actual cost of performing the service in one territory, in order to compete with water transportation, it must make up the deficiency by charging an excessive rate in some other territory where such competition does not exist.

The above principles might be easily applied in regulating the rates made by the railroad companies, in competition with water carriers, by changing the administration of the "long and short haul clause," and do strict justice to all interests concerned. It is not necessary to amend the Inter-State Commerce Law in any particular in order to permit the application.

In order to apply these principles it is necessary to have

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some figures of cost to start from, and the foundation on which to base these is already available in the reports now made to the Inter-State Commerce Commission. It is not necessary to disturb the present rate fabric in any way.

The cost of performing service by a railroad is made up of two items, "operating expenses" and "fixed charges"—this latter including interest, taxes and all expenses aside from the expenses of operation and maintenance. These expenses cannot be sub-divided so as to determine exactly what portion should be charged against any particular class of traffic, as, for instance, between freight and passenger traffic, and consequently no absolutely accurate figure to represent the cost of performing the freight service per unit can be determined, but it is not necessary so long as the same method is followed in all cases.

As at present rendered the accounts show costs and receipts of operation in units of "passenger miles" and "ton miles." A third unit might be adopted called the "general unit mile," or simply "unit mile," made up in the following way: Assume for the purpose of this unit that passenger miles and ton miles are the same kind, add them together and divide into the total of fixed charges to get a "general unit" overhead charge. Determine the relative percentages of the passenger miles and the ton miles to this sum, and multiply the "general unit" by the percentage of the ton miles to get the proportion that belongs to the freight traffic. Add this to the ton-mile cost of operation to get a total cost per ton mile for freight traffic, which will have to be the absolute minimum that can be received for services if the company is to continue solvent. In a similar manner the general unit-mile revenue can be determined, and the difference between them will show what will go to the stockholders or be available for improvements. This total cost per ton mile will then furnish a base from which the principles already stated can be applied.

When a railroad comes to the Commission with an application for permission to make a rate, using as an argument that it is asked in order to meet water competition, it should be required also to show the mileage over which the rate is to be operative and the subdivisions of the rate, if two or more roads are interested, or if part of the route is via a water carrier. The rate per ton mile should be determined from these figures for each of the railroads interested. If this rate per ton mile should prove less for each road concerned than the total cost per ton mile as above determined, the rate should be refused unless some strong specific reasons, other than the meeting of water competition, applicable to the particular commodity are given. If it is not refused it will be absolutely certain that the railroad concerned will recoup itself for the losses it will incur on the particular traffic involved by maintaining an unjustly high rate on other traffic where it does not have to meet water competition. The total cost per ton mile is the figure that should be used, because it takes into consideration, besides fixed charges, freight traffic and all variations of train load, empty car mileage, distribution of cars, repairs, terminal expenses and all the multifarious items that go to make up the cost of operating the railroad which would not be the case if the cost of handling any particular class of traffic only was considered. It is proper from an economical standpoint also, because the cost of handling the unit of weight (ton) per unit of distance (mile) is a measure of the efficiency of any interest engaged in the transportation of commodities.

It has been the failure to apply this, or some similar plan based on the cost of performing the service, that has been the cause of the practical destruction of water traffic, not only on inland waters but the coastwise traffic as well, and it is extremely doubtful if it can ever be revived unless it is protected in some way. If water transportation is more efficient than rail it should be protected from destructive competition, and if not it should be so demonstrated and be allowed to die a natural death and be decently buried; it should not be destroyed because for the time being it happens to be in the power of the railroads to destroy it.

The application of this plan would do no injury to any interest or section. It would not injure the railroads, in which the savings of the public are invested, because they would not be permitted to perform a service for which they received a sum less than cost. It would not injure the purchasers of transportation, because those receiving a service for less than cost have no right to demand that others should pay an excessive rate for its service in order to make up the deficiency. It will not give the water transportation anything to which it is not economically entitled, because if it cannot perform the service at a rate equal to or less than the cost to the railroads it is not as economical and cannot expect to be supported. It furnishes a ready means of regulating and steadying rates, because rail rates could not be advanced beyond a certain point without making water transportation profitable. It would still leave the incentive to both the railroads and the water carriers to increase their economies, in the one case so as to show the lower cost and get the lower rate to meet the water competition, and in the other case to be able to keep their rates low enough to command their share of the trade. It does not violate any law of economics as does any rule that requires a specific differential between the rail and the water rates. The principle, though not so stated specifically, is in practical operation in Germany, where the State-owned railroads will not make any rates at a cost less than the cost of performing the service, and there is the fiercest kind of competition between the water carriers on the free canals and rivers and the State-owned railroads. And it is in Germany where water transportation has reached its highest development and where the most money has been spent in improving inland waterways. This has been accomplished under true economic conditions, as competition is unrestricted except that no service is permitted at less than actual cost, which in the long run is good economics.

In certain cases the railroads are accustomed to use what they call "constructive mileage," which is a device to permit the subdivision of a rate on a mileage basis so as to give some particular portion of the route a larger proportion of the total rate in order to offset some unusual expense, sometimes also because some portion of the route happens to be in a position to dictate it and "get it." In cases of this kind the "constructive mileage" should be used in comparing the through rate with the total cost per ton mile, for the reason that it exists solely because of some unusual expense. An illustration of this "constructive mileage" is the route from Norfolk to Boston via Cape Charles, Va., and New York over the Pennsylvania Railroad and the New York, New Haven & Hartford Railroad. The freight is loaded on cars at Norfolk and ferried across Chesapeake Bay on floats, the distance is about 20 miles, while the "constructive distance" allowed the Pennsylvania Railroad is 100 miles. It is ferried around New York from Jersey City to the Harlem River terminal, which is a distance something less than 10 miles, and the constructive distance allowed the New York, New Haven & Hartford Railroad is 50 miles, making the total "constructive distance" more than 100 greater than the actual distance, because of the extraordinary expense involved in the ferriage and the practical necessity of the maintenance of two terminals where ordinarily one would be sufficient. Like many other devices this can be abused, and if requiring the plan under discussion to be applied to the "constructive distances," where they exceed actual distances, will eliminate the abuses something will be gained for the railroads themselves, especially the weaker lines.

In order to put this plan in operation it is not necessary in

any way to modify the laws already in operation; in fact, it would be better not to modify them. All that is required is a change in the administration of the law, and this is entirely within the control of the Commission. Whether it would be advisable to review the rates already in existence and bring them under the plan outlined is open for argument on both sides. It might be advisable in specific cases to review them on the application of some interested parties, who could show in their preliminary application that they can perform the service by water transportation, at a profit to themselves, at a rate equal to or less than the actual cost to the railroads involved in performing the service, and also that they are ready and have the capital to get into water transportation and compete for the traffic if they are given an equal fighting chance. This would give all the encouragement that can be logically asked for the restoration of water transportation where it has already been destroyed by unprofitable rates to the railroads.

While at the first glance it might be argued that the rule of not allowing any rate to be made at less than the actual cost of performing the service would be a good one to apply to all rates, a closer study of the case will show that this is not true. A railroad handles all classes of freight, commodities from the lowest to the highest classes, and its earnings are the difference between the total amount received for all the transportation and the total cost of performing the service. In a number of instances, as, for instance, the handling of fuel, a rate at less than the cost of performing the service permits the development of the manufacture of some commodity that requires the consumption of fuel into other commodities that will be transported in the higher classes paying the higher rate, so that the earnings of the railroad are increased without increasing the expenses of the service, since the expenses will be the same whether a remunerative rate is charged or not. It is not the same with the waterway, since, by virtue of its lack of speed and its inability to reach all points of delivery, its traffic is limited to what are called the lower classes of freight, of which fuel is an example. Furthermore, the very premise of this argument is based on the protection and encouragement of water transportation.

The question as to whether, from an economical point of view, water transportation should be developed at all is a debatable one, and there are plenty of arguments on both sides, but they cannot be included in this article.

English Shallow Draft Boats for Foreign Service

During the last few years a great variety of shallow draft vessels, ranging in size from a 60-foot motor boat to a 260-foot paddle steamer, have been built by Ritchie, Graham & Milne, Whiteinch, Glasgow, for foreign service. One of the largest of these is the stern-wheel steamer *Victoria,* shown in the accompanying illustration, which is 200 feet long, 28 feet beam, with a molded depth of 5 feet 6 inches. The steamer is propelled by 750-horsepower compound-surface condensing engines, and was built for the Anglo-American Steamship Company for tourist service on the River Nile.

Even larger than the *Victoria* is the paddle steamer *Shalimar,* which is used as a railroad ferry across the River Hooghly, India, to connect two railway systems. The hull is 260 feet long, 45 feet beam, with a molded depth of 11 feet, and is equipped with engines aggregating 1,200 horsepower. Three lines of track and six turntables are fitted on the deck for the transportation of the railroad trains.

Other recent productions of shallow draft steamers by this company include the stern-wheel steamer *Congolia,* 75 feet by 14 feet by 3 feet 6 inches, molded, with high-pressure engines of 30 horsepower, built for passenger and cargo service on the Congo River, and the towing steamer *Rio Machado,* 180 feet by 36 feet by 9 feet, molded, with triple-expansion engines of 900 horsepower, giving the vessel a speed of 12 knots, built for passenger and cargo service on the River Amazon in South America.

A STERN-WHEEL, ENGLISH-BUILT STEAMER FOR SERVICE ON THE NILE

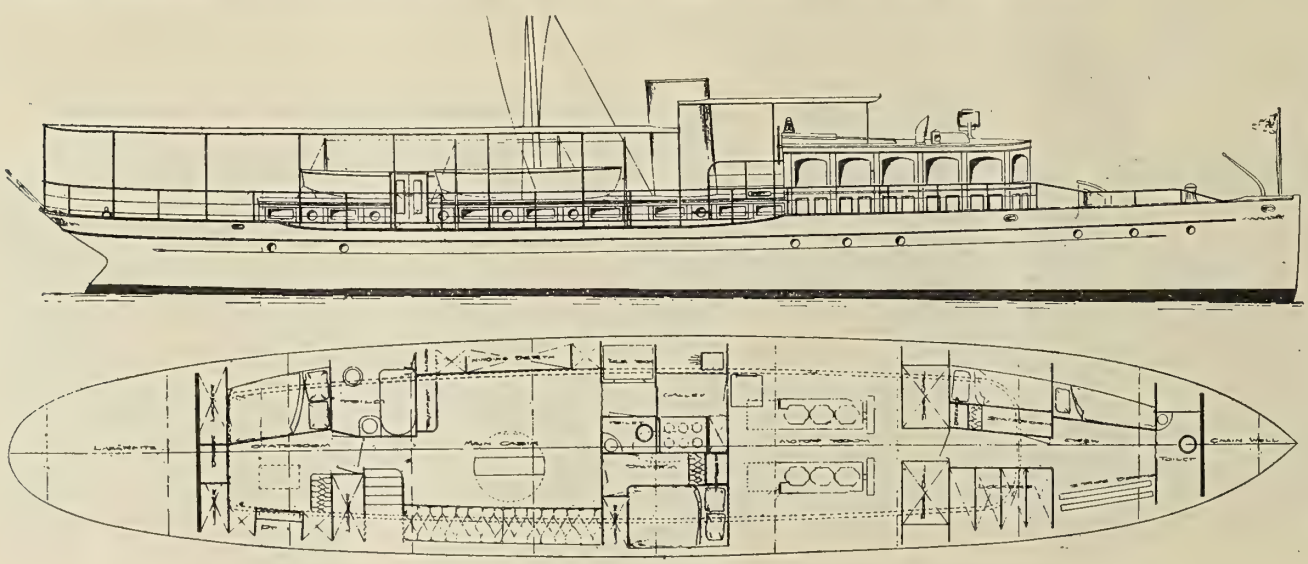
A Twin Screw Shallow Draft Motor Boat with Tunnel Stern

Since the average cruising motor boat is of small size, the necessity of designing a special type of motor boat for shallow draft work has not been apparent to many, but when it is known that in order to navigate some of the most interesting parts of the rivers in Florida it is necessary to have a boat whose draft is less than 30 inches, it is evident that something besides the ordinary ocean-going cruiser must be used. For use in such waters an interesting type of shallow draft motor boat has been built by the Matthews Boat Company, Port Clinton, Ohio, for Mr. H. W. Baker, St. Paul, Minn. The boat, named the *Wethea,* is a twin-screw 82-foot tunnel stern yacht which, with a displacement of 90,000 pounds, draws only 28 inches of water, and makes a speed of 14 miles an hour with two 60-horsepower heavy duty engines.

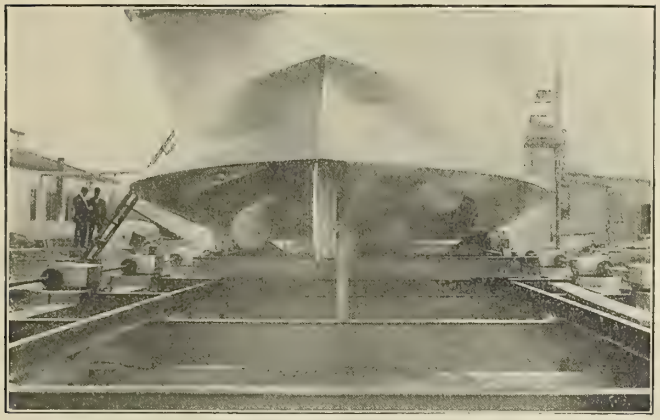
THE WETHEA AT FULL SPEED

The *Wethea* is not only a wide departure from the ordinary type of cruising yacht on account of its limited draft, but it is so designed as to be capable of navigating not only shallow bays and rivers, but also the open, unprotected waters where heavy seas are encountered.

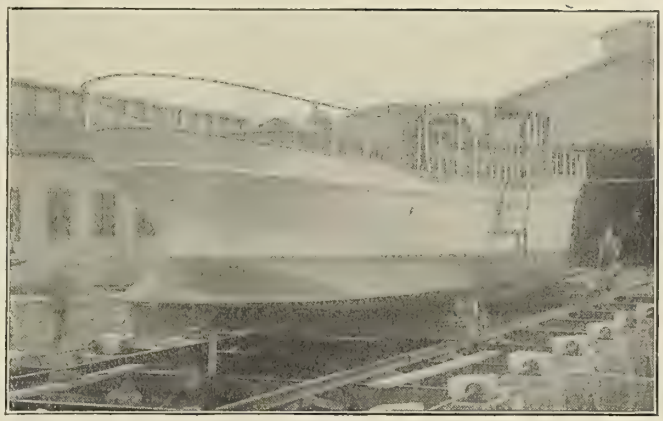
The unusual feature of this boat is the tunnel stern, which not only reduces the draft to the desired limit, but also forms a thorough protection for the propellers. Ordinarily a large amount of floating débris is found in shallow water, and there is a tendency for the propellers to become entangled by sucking the floating material under the stern, but in the *Wethea* the propellers are entirely housed by the tunnel shape of the stern, which, owing to the construction of the chime piece, extends well under the waterline.



82-FOOT TUNNEL YACHT WETHEA, FOR SERVICE ON THE MISSISSIPPI RIVER AND FLORIDA WATERS



VIEW OF TUNNEL STERN

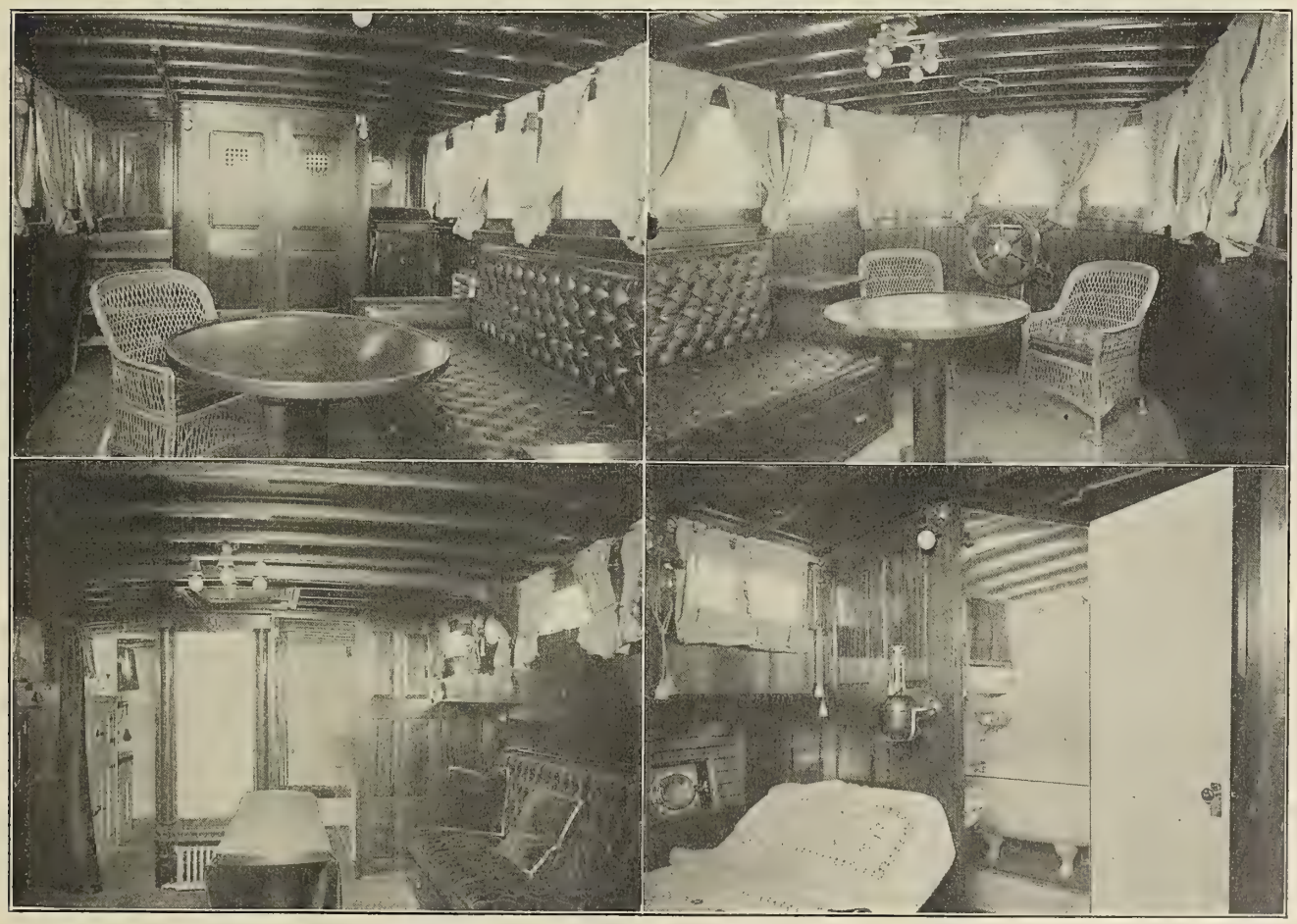


UNDER-WATER BODY

The hull, which is 82 feet long and 14 feet wide, is divided by two steel watertight bulkheads and two wooden watertight bulkheads located at the ends of the boat. The planking is of long leaf yellow pine below the waterline and white Virginia cedar above the waterline. The decks are of double thickness calked pine and all the houses are finished in African mahogany throughout.

The crew's quarters, captain's room, storeroom, etc., are located forward of the engine room, which is separated from the other parts of the boat by the steel bulkheads already mentioned. Aft of the engine room the rest of the boat is taken up with the owner's and guests' quarters, together with the living room. Immediately aft of the engine room is the galley, fitted with a large refrigerator, coal range, provision lockers, etc. Aft of the galley are the guests' accommodations, finished in light blue and gold trimming. Immediately aft of the guests' accommodation is the general cabin or dining saloon, with a companionway to the deck. This cabin is fitted for the use of chairs and a divan seat, the total length of the room being about 13½ feet. On the port side is a folding panel berth, which gives room for three sleeping berths in this compartment. The after part of the boat is given up entirely to the owner's quarters, which are elaborately furnished, as shown in the illustration.

The engine room contains two 60-horsepower, 6½-inch by 8-inch Sterling heavy duty gasolene (petrol) engines, together with gasolene (petrol) tanks of 600 gallons capacity. There is a Fay & Bowen independent electric light 4-kilowatt plant which furnishes current for lighting and operating fans and other accessories. The boat is heated throughout by hot water with radiators in each room.



INTERIOR VIEWS OF THE WETHEA

Launch of Collier Middlesex

The New York Shipbuilding Company, Camden, N. J., launched the steel collier *Middlesex* Sept. 21, for the Coastwise Transportation Company, Boston, Mass. The ship is of the following dimensions:

Length between perpendiculars	377 feet 4 inches.
Beam, molded	50 feet.
Depth, molded	33 feet.
Draft, loaded	25 feet.
Cargo carried at this draft	7,250 tons.
Gross tonnage	4,730 tons.
Speed at sea, loaded	10 knots.

The vessel has a single deck of steel, with poop 80 feet, bridge 17 feet, and forecastle 34 feet long with seven steel watertight bulkheads, two pole masts, straight stem and semi-elliptical stern. A deep double bottom is fitted all fore and aft for the carriage of water ballast, and particular attention has been paid to the construction of this part of the vessel; the plating being of extra strength and fitted flush; no wood ceiling is fitted.

The five cargo holds are entirely clear of beams and pillars, the deck being supported by deep arched beams and web-frames placed midway between the watertight bulkheads; a continuous trunk, 24 inches deep by 30 feet wide, is carried on the upper deck for the full length of the cargo spaces. Large steel cargo hatches are in the top of this trunk, eleven in all. Six steam winches are fitted in connection with five pairs of king posts for raising the hatch covers and securing them in place when open.

The accommodations consist of a 'midship deck-house on the bridge deck for the captain's stateroom and spare room, with a pilot-house over. The saloon officers' and petty officers' berths, pantry, toilet, etc., are in the bridge; the engineers, cooks, steward, messrooms, refrigerator, toilets, galley, etc., are in the houses on the poop deck, and the oilers, seamen and firemen are berthed in the poop abreast the engine casing.

The steam windlass is fitted with warping ends and located on the forecastle deck, with the engine below in forecastle. The steam capstan is on the after end of the poop deck, with the engine below. The steam steering gear is on the upper deck abaft the engine casing, with connection to the steering stations in pilot-house and on the navigating bridge; auxiliary hand-steering wheels are also provided.

The propelling machinery is placed aft, and consists of one triple-expansion, inverted reciprocating engine of about 3,100 indicated horsepower and two single-ended Scotch boilers, having a working pressure of 175 pounds.

The vessel is intended for the coastwise coal-carrying trade between Baltimore and Boston. Loading and discharging gear is not fitted on board, the two terminal points being arranged with these facilities.

American River Boats for Foreign Service

During the last year the steamboat builders on the Western rivers of the United States have had very little business for American owners outside of government work, but the shipyards have been fairly busy with foreign contracts. James Rees & Sons Company, Pittsburg, Pa., which is one of the pioneer river steamboat builders, has turned out during the last year fourteen sternwheel river boats for the Companhia Navegacao do Amazonas of Brazil in fulfilment of a contract made in Paris the latter part of July, 1911. These boats have been shipped to Brazil in knock-down form and eight of the boats have already been launched at Para. One of these went into service on the Amazon early in August, leaving the port of Para for a three-months' voyage up the Amazon and one of the tributaries with a commission on board sent out to examine and report on the conditions and future prospects of the valley. This boat carried 90 tons of fuel and freight, besides passengers, baggage, etc., on 2 feet 8 inches draft forward and 2 feet 3 inches draft aft. The consumption of fuel for twenty-four hours was estimated at 5 tons of dirt coal and her steering qualities met with ready approval.

AMERICAN RIVER-BOAT PRACTICE CARRIED OUT ON THE NILE BY THE TOWBOAT EGYPT

Another successful boat built by this company for service on the Magdalena River in the Republic of Colombia, South America, was the *Perez Rosa,* a boat 170 feet long, 33 feet beam, 5 feet depth of hold with a capacity for 500 tons. This boat was described in some detail in the November, 1911, issue of INTERNATIONAL MARINE ENGINEERING. Since going into service she has made several very successful trips.

Included in the work now on hand in the yards of James Rees & Sons Company are two steamboats 75 feet by 18 feet by 3 feet for the Madeira and Mamore Railway Company of Bolivia, and one light-draft river gunboat and ram, the hull of which is nearly completed. They also have six barges under construction for Bolivia.

Another interesting boat built by this firm for foreign service is the river towboat *Egypt,* which has been in service on the river Nile for some time. The methods of towing on the Nile heretofore were quite different from the methods used on the Western rivers of the United States, but since the *Egypt* was put into service, aided by the instructions supplied by the builders, the pilot of the boat, who was a native who had never been on a sternwheel boat before, rapidly picked up the principles of towing with a sternwheel steamer, and the vessel now handles a tow of 900 tons up the river on a fuel consumption of 800 pounds of coal per hour, making regular trips of 1,600 miles a month.

Shallow Draft Motor Boats for Commercial Purposes

The remarkable development of motor boating as a sport has been followed by a no less remarkable development of the motor boat for commercial purposes. Although this phase of motor boating has not attracted so much attention as has the use of the racing craft or the cruiser, nevertheless the adaptation of the motor boat to commercial purposes has rapidly increased, especially in shallow waters such as harbors, bays, rivers and their tributaries, where the demand for a small, inexpensive boat makes the motor boat a formidable competitor to the large steamboat on which river traffic formerly depended. It is impossible to lay down the details of any representative type of commercial motor boat, as the design depends upon local circumstances and the kind of traffic which must be handled, but from the great number of different types that are in use a few representative examples may be selected.

FIG. 1.—MOTOR TUG NEMADJI

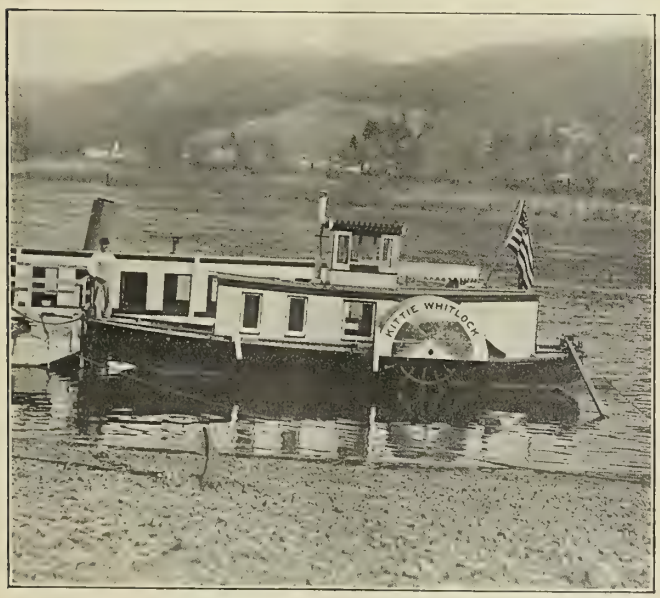


FIG. 2.—A SIDE WHEELER DRIVEN BY A 15-HORSEPOWER BUFFALO ENGINE

Out on the Great Lakes the Racine Boat Company, of Racine, Wis., has recently delivered to the United States Engineers at Duluth, Minn., a thoroughly up-to-date motor tug which is proving a valuable adjunct to the engineering department. The boat is 60 feet 9 inches long over all, 55 feet 10 inches long on the waterline, with a beam of 12 feet and a draft of 4 feet. The tug is of heavy construction throughout, the keel being a clear, well-seasoned white oak, sided 6 inches and tapered to 4 inches at the after end. The center keelson is one length of long-leaf yellow pine sided 6 inches and molded to a depth of 4 inches; the side keelsons are of yellow pine sided 3 inches and molded 2½ inches. The frames are of white oak, sided 2 inches and molded 2 inches at the hood and 3 inches at the heel, spaced 12 inches. Bulkhead stringers of yellow pine, sided 3 inches and molded 2½ inches and tapered to 3 inches by 2 inches, are fitted, as also are side stringers of yellow pine, 3 inches by 2½ inches tapered to 3 inches by 2 inches. The stern post is of oak, sided 2 inches, and the stem of white oak, sided 6 inches and molded to a depth of 18 inches. The garboard strakes of planking are of white oak 2 inches thick, the next two planks being 1⅞ inches thick. The rest of the planking is 1¾ inches thick.

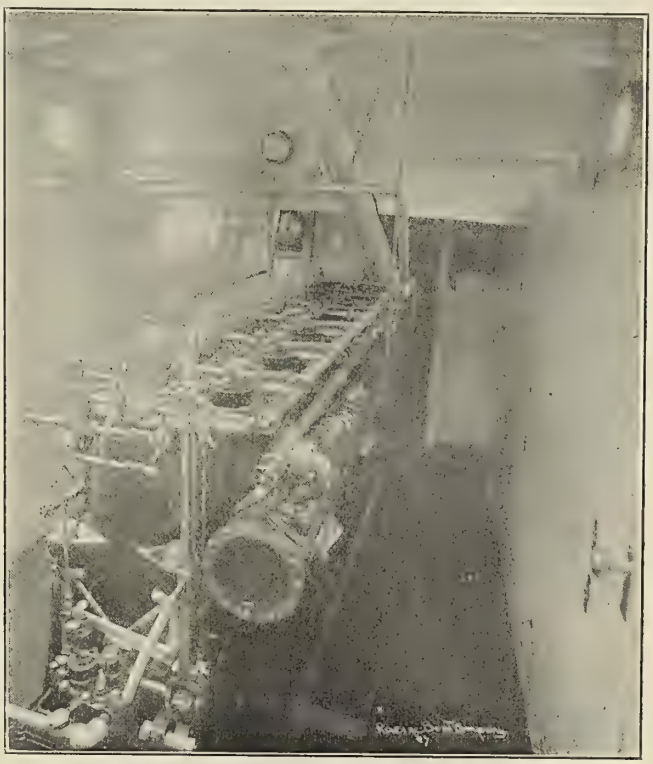


FIG. 3.—ENGINE ROOM OF THE NEMADJI

FIG. 4.—LAKE GEORGE MOTOR BOAT MOUNTAINEER

The motive power consists of a 125-150 horsepower air starting and reversing Standard engine, built by the Standard Motor Construction Company, Jersey City, N. J., which gave the *Nemadji,* as the boat is called, a speed of 12.38 miles an hour on a trial run from Racine to Milwaukee and return.

In the engine room is also installed an electric generator of 15 volts, 15 amperes capacity with storage batteries of 13 volts, 120 amperes capacity, and a switchboard for lights. Electric lighting is used throughout the boat and a hot water heating system is installed.

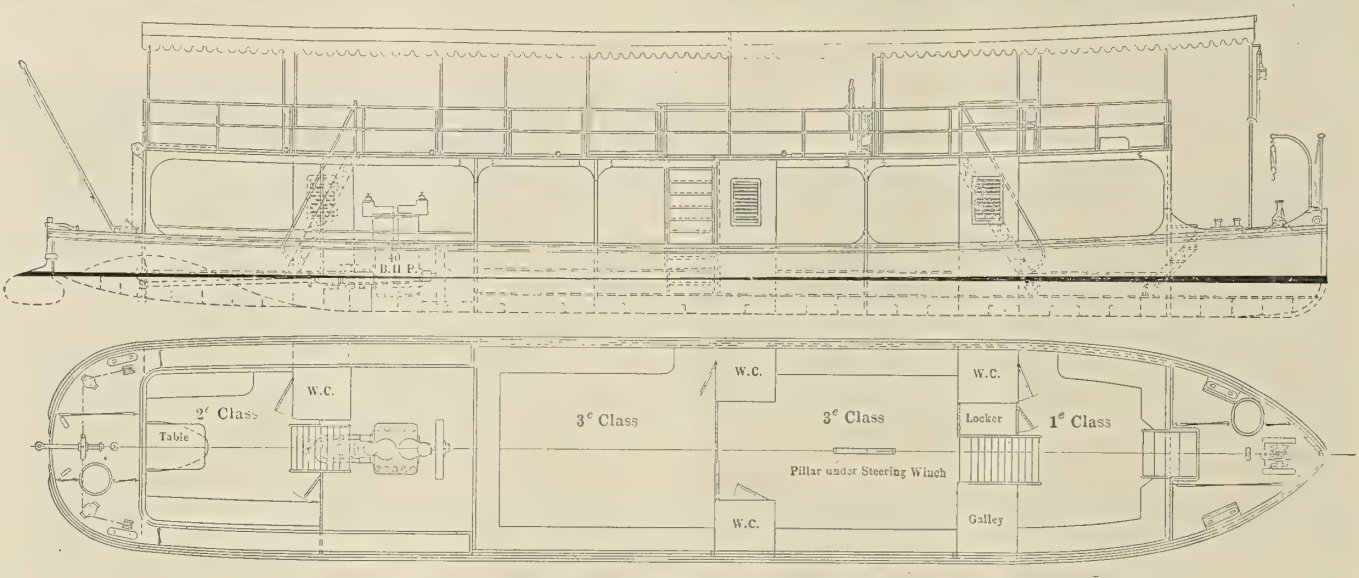


FIG. 5.—MOTOR TUNNEL BOAT BUILT BY MESSRS. KROMHOUT IN HOLLAND

In the extreme fore peak is the chain locker; aft of this are the crew's quarters and sleeping accommodations for four persons; aft of the crew's quarters comes the engine room and aft of that the galley where the hot water heating system is installed. Aft of the galley is the officer's saloon, making a very comfortable and conveniently equipped motor boat for a tug.

Another type of motor boat which is used in competition with steamboats is the *Mountaineer,* which is a passenger boat 70 feet 10 inches long over all, 12 feet 6 inches beam, and 3 feet 6 inches draft with a full load of sixty passangers. This boat is owned and operated by the Lake Champlain Transportation Company on Lake George and is used as a sight-seeing craft. She was designed by J. W. Millard & Brothers of New York, naval architects of the large Hudson River day boats. She was built by Alexander McDonald of Mariner's Harbor, Staten Island, N. Y. For motive power the boat is fitted with a 125-150 horsepower 6-cylinder air-starting and reversing Standard engine, built by the Standard Motor Construction Company, Jersey City, N. J. The engine drives a propeller 40 inches diameter and 50 inches pitch. There is a shaft tunnel aft to admit this wheel. The motor is located amidships, where a gangway crosses the boat just abaft the motor, with steps leading aft to an after cabin and forward on the starboard side past the motor to the forward cabin. A Standard auxiliary generating set is also located in the engine room.

Motor tunnel boats are also frequently used for light draft canal work and harbor construction. A typical boat of this kind for passenger service not only in shoal protected waters, but also suitable for heavy sea work, has been constructed by Messrs. Kromhout Works at Amsterdam, Holland. We are indebted to Mr. F. W. Uittenbogaart for the following particulars of a typical boat of this class:

The principal dimensions are: Length over all, 70 feet; beam, molded, 11 feet 8 inches; depth of side, 3 feet 8 inches. The draft when loaded with 150 passengers is only 22 inches, while her designed speed is 8 miles per hour. The vessel was built for service in the Far East and shipped there in knock-down form, after being erected and taken adrift in the builder's yards. As shown in Fig. 5, the vessel has two decks and an awning covers the entire length of the vessel. She is divided into six compartments. The forepeak is used for a chain locker and also contains a galvanized iron water tank. It is separated by a watertight bulkhead from the space reserved for first-class passengers. A small galley is fitted in this part of the boat. Immediately aft of the first class compartment is a space devoted to third class passengers, being

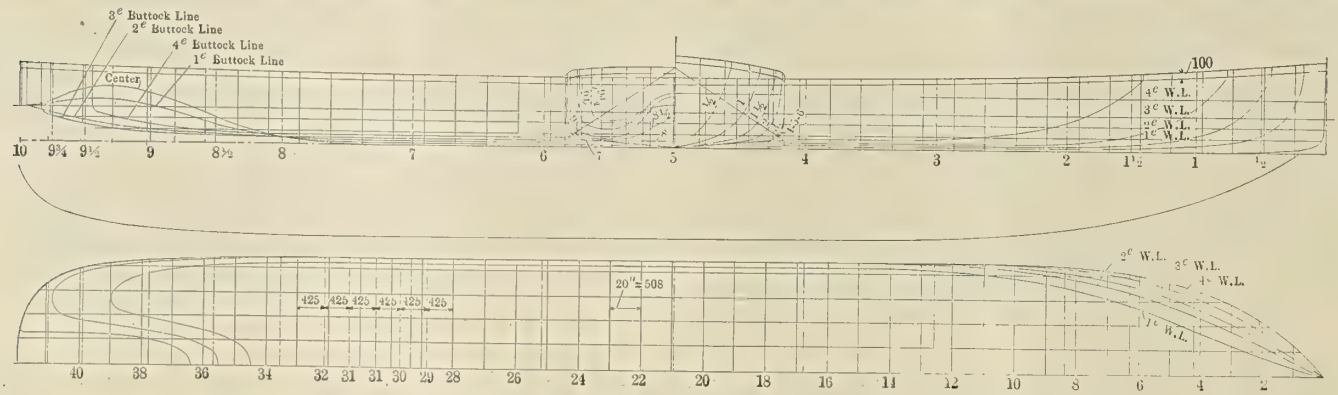


FIG. 6.—LINES OF HOLLAND MOTOR TUNNEL BOAT

divided by a bulkhead into two sections, one for women and one for men. Immediately aft of this space is the engine room. Aft of the motor room is a space reserved for second class passengers. The hull is built of steel throughout and is necessarily of very light construction. The shell plating, which is of galvanized steel throughout, is of only ⅛-inch thickness. The weight of the whole vessel, exclusive of the propelling machinery, amounts to 12.4 tons.

the engine. Magneto ignition is used. The fuel consumption of this motor in actual service is about 16 pints of oil per hour.

Another typical tunnel motor boat for shallow draft service is the 35-foot launch shown in Fig. 7, which was built by MacLaren Brothers, Ltd., Sandpoint Shipyard, Dumbarton, for service in South Africa. She is fitted with a 30-horsepower motor and has a guaranteed speed of 10 knots. Owing to the special type of shallow draft tunnel stern, this launch

FIG. 7.—TUNNEL LAUNCH IRENE, BUILT BY MAC LAREN BROS. FOR SOUTH AFRICAN SERVICE

As can be seen from the lines (Fig. 6) there is a tunnel which extends from the stern to over half the ship's length. The metacentric height is 24 inches when the vessel is loaded with eighty passengers on the upper deck and seventy in the spaces below.

The propelling machinery consists of a two-cylinder, four-cycle Kromhout kerosene (paraffin) oil engine of 40 brake horsepower with cylinders 9.06 inches diameter by 11.81 inches stroke. The fuel used is ordinary kerosene (paraffin), which can be obtained practically everywhere. The oil is fed to the motor by an automatic pump controlled by the governor of

when loaded with her complement of passengers does not draw more than 14 inches of water. She is used by the owner for commercial purposes, as the shallow rivers are the only means of communication in that part of the country.

For trading purposes in the central of Africa, the Seamless Steel Boat Company, Ltd., Wakefield, has built and shipped in knock-down form a motor barge 80 feet long, 15 feet beam and 5 feet depth of hold, fitted with a 40 brake horsepower heavy oil motor, which gives the barge a speed of from 6½ to 7 miles per hour when carrying 80 tons of cargo on a draft of 3 feet 9 inches. The design of the barge

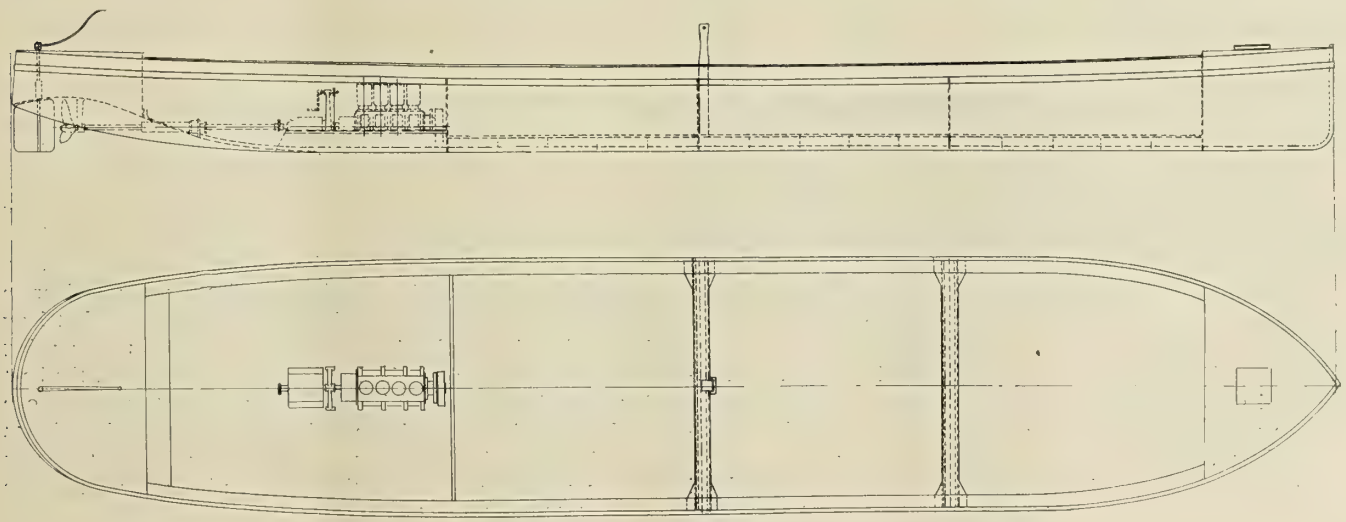


FIG. 8.—SEAMLESS STEEL MOTOR BARGE, 80 FEET BY 15 FEET BY 5 FEET

is similar to several other types of seamless steel shallow draft launches built by this company.

Messrs. John I. Thornycroft & Co., Ltd., of Woolston Works, Southampton, has built to the order of the British & American Tobacco Company a unique twin-screw motor launch called the *Rosette,* which is intended for river service at Hong Kong, carrying samples of goods. The little vessel was required to have a fair turn of speed, 9 knots being guaranteed, and the draft when loaded with 2 tons was not to exceed 1 foot 3 inches on account of the shallowness of the river. Living quarters were to be arranged for the crew and officers and also a certain amount of bulky cargo had to be carried.

On trial the *Rosette* fulfilled all that was required of her, a speed of nearly 9¾ knots being obtained on 1 foot 3 inches draft when loaded with 2 tons. The general arrangement is as follows: A short deck is arranged forward for working anchors, warps, etc., with a saloon for four people fitted with

FIG. 9.—THE ROSETTE IN RIVER SERVICE AT HONG KONG

berths, etc. Opening off the saloons are galley and pantry and toilet. Amidships is fitted the cargo hold, divided into two spaces and fitted with sliding doors. The motor space is located abaft the cargo space and abaft that again is a space for the crew. The house over the accommodation is carried right out to the ship's side, and to provide a passage fore and aft a battened platform is built out at the sides, supported off the ship's side by means of tube stays. A bridge deck is arranged over

FIG. 10.—PRODUCER GAS BOAT ST. LUCIE

the forward accommodation and is provided with canvas awning and curtains.

The propelling machinery consists of two sets of Thornycroft M-4 type of motor using kerosene (paraffin) as fuel. The engine is designed specially for marine work and fitted with standard vaporizer. The motors drive solid propellers of Thornycroft bronze through standard combined clutch and reversing gear.

Internal combustion engines for commercial motor boats are not limited to the use of gasolene (petrol) for fuel, since certain types of engines are built which can be adapted to the use of various grades of oil, including kerosene (paraffin), distillates, coal oil, alcohol, and during recent years some of them have been showing great economy through the use of producer gas. The Wolverine engines, manufactured by the Wolverine Motor Works, Bridgeport, Conn., have been used in many kinds of work, such as towing, freighting, dredging, fishing and for passenger service in all parts of the United States, as well as in the bays and rivers of many foreign countries, such as South America, Africa, Belgium, Holland, France, etc. Some 75-horsepower engines of this type have recently been installed on river boats in Florida in connection with suction producer gas plants, with excellent results as to operation, but the most interesting feature regarding this fuel

FIG. 11.—THE SELKIRK

is the great saving in running expenses; as, for example, in one instance a 75-horsepower engine operating on gasolene (petrol) required a bill of $65 (£13.3) a trip for fuel, as against $10 (£2.3) spent for coal on the same run—a saving of $55 (£11.3), or about 85 percent on each run. Since this boat made two runs a week, this meant a saving of $110 (£22.6) a week to its owners on account of the change from gasolene (petrol) to producer gas. Instances of this sort certainly furnish food for thought for anyone owning or contemplating the ownership of a marine gas engine for work or pleasure.

Fig. 10 shows a light draft freight boat, the *St. Lucie,* 114 feet 6 inches long over all, 23 feet 2 inches beam, and 3 feet draft, equipped with a 75-horsepower producer plant capable of giving the boat a speed of 8 miles per hour. This boat is said to be the first stern wheeler in the world fitted with a producer gas plant, and since she has been in use on the St. John's River in Florida she has scored a victory in both speed and reliability over the older steamboats on that river.

Another interesting boat equipped with a smaller Wolverine engine is the *Selkirk,* shown in Fig. 11, which is 68 feet long by 11 feet beam, fitted with a 27-horsepower motor using gasolene (petrol) as fuel. In the photograph shown, the boat is towing in the usual Western river manner two scows, one 50 feet long by 16 feet beam and the other 62 feet long by 14 feet beam, each drawing 3 feet of water. This tow was driven upstream against a three-mile-an-hour current at the rate of fifty miles a day.

An English Type of Shallow Draft Towboat

Fig. 1 shows a type of single-screw towing launch of 4 feet draft for river and sea work combined, which is manufactured by Edward Hayes, Watling Works, Stony, Stratford. The boat is 51 feet long over all, and 11 feet wide, with 6 feet

FIG. 1

FIG. 2

2 inches depth to the deck at the side amidships. The engine is of the standard Hayes type, built especially to meet the requirements of such a craft, having cylinders 8 inches and 16 inches diameter by 10 inches stroke. There is a large condenser and brass-lined air and circulating pumps of large capacity, together with feed and bilge pumps, the latter having interchangeable valves. A special three-bladed propeller of high towing efficiency, running at 260 revolutions per minute, is used. Steam is supplied by a marine return-tube boiler, built for 120 pounds working pressure. Roomy cabins, well ventilated and fitted out with all conveniences, are arranged forward and aft under the deck. For tropical work an awning is placed overhead on a galvanized frame with suitable gangways. The speed of this type of boat on trial is usually a little over 12 miles per hour, this varying slightly with weather conditions at the time of the trial.

Fig. 2 shows another standard type built at the same works for a draft of 3 feet, where good towing power is required. The boat is 60 feet long, 11 feet wide, and is propelled by twin screws driven by separate compound engines, having cylinders 6 inches and 12 inches diameter by 8 inches stroke, running at about 350 revolutions per minute, both exhausting into separate condensers of the vertical type, built very low and placed in the center of the boat just aft of the engines. This condensing plant was designed by the builders especially for shallow draft work, and it is so located that the deck comes over it, thus giving considerable extra deck space for stowing bulky cargo which otherwise would not be secured. The pumps on this boat are driven by a small compound surface condensing engine, having cylinders 3½ inches by 7 inches diameter by 5 inches stroke. The usual type of marine return-tube boiler is used for furnishing steam, and the speed of this type of boat is usually about 11 miles per hour.

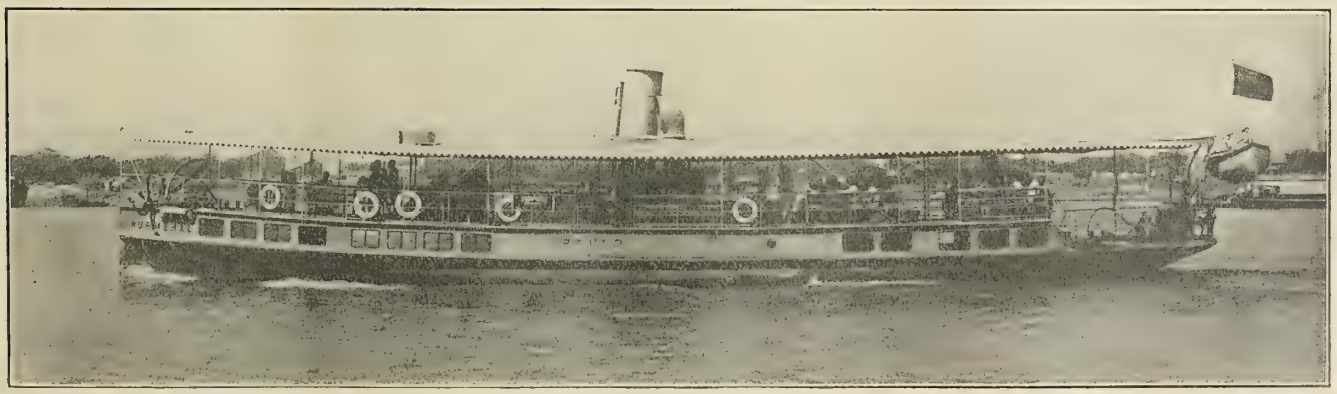
Shallow Draft Ferry Steamers

For shipment in knock-down form to India, Messrs. John I. Thornycroft & Company, Ltd., of Southampton, are building two interesting shallow draft ferry steamers for service at Calcutta. The principal dimensions of the vessels are as follows:

Length between perpendiculars	100 feet.
Breadth	24 feet.
Depth	7 feet 6 inches.
Draft, maximum	3 feet 2 inches.
Speed	10 knots.

The vessels are arranged to carry in all about 200 passengers, seating accommodation having been arranged for 100 of these. The passenger space is divided into two classes, the first class being situated forward on the upper deck in front of the boiler casing, and separated by portable barriers from the remainder of the space, which is set apart for second class passengers.

On the upper deck there are four wide gangways on either side, giving ample room for embarking large numbers of passengers quickly. Two of these gangways are arranged for first class passengers and the other two for the second class. The upper deck has a fine area, and will be capable of ac-



ONE OF THE CALCUTTA FERRY STEAMERS

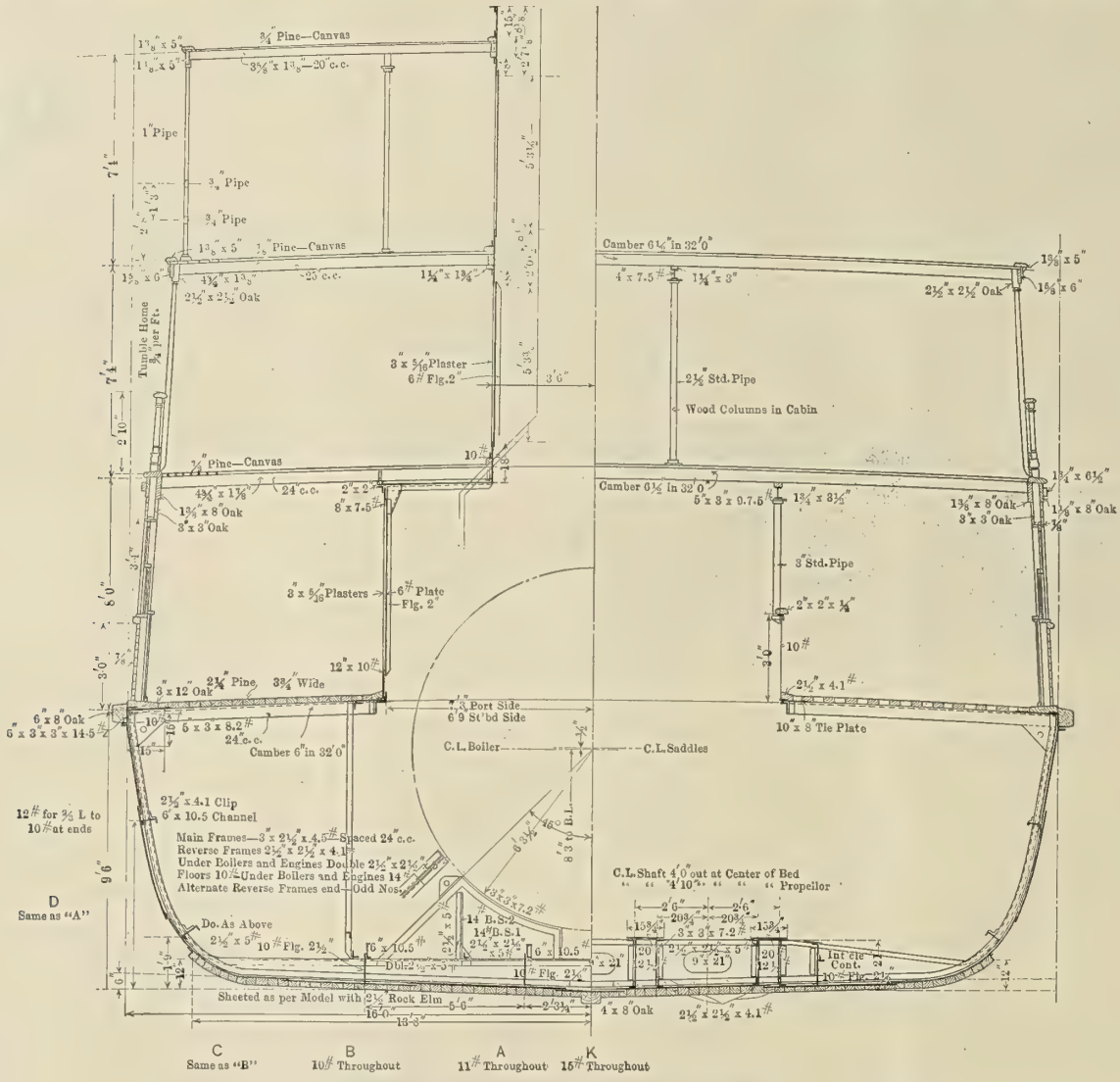
commodating a large number of passengers with comfort. A light wood awning covers this deck.

The machinery will consist of two sets of vertical, triple-expansion condensing engines, supplied with steam from one cylindrical boiler working under forced draft on the closed stokehold principle.

These vessels are generally similar to eleven others built within the past few years by Messrs. Thornycroft for the same authority, but are of somewhat shallower draft and less speed. In the present case, as previously, the boats will be shipped in pieces and re-erected at Calcutta, where they will be placed in service.

Shallow Draft, Tunnel Stern Steamer Thousand Islander

The steamer *Thousand Islander* was built in the spring of 1912, and delivered in July of the same year by the Toledo Shipbuilding Company, of Toledo, Ohio, for the Thousand Island Steamboat Company, of Clayton, N. Y. The principal dimensions of the vessel are:



MIDSHIP SECTION OF THE THOUSAND ISLANDER

Length over all	172 feet 9 inches.
Beam, molded	32 feet.
Depth, molded	9 feet 6 inches.
Gross tonnage	355
Net tonnage	241

The ship is of the tunnel stern, shallow draft, twin-screw type, and is built with main, promenade and boat decks. There is life-saving equipment enough for 1,000 passengers, included in which are three 18-foot lifeboats and one 14-foot working boat. All decks, cabins, etc., above the main deck are constructed of wood, while that part below the main deck is of steel.

General Arrangement

The hold is arranged for the chain locker, crew's quarters and power plant. From frame No. 1 to No. 16 there are accommodations for four firemen and seven deck hands. There are stateroms enough from frame No. 16 to No. 26 to care for the souvenir boys, mess boy, bartender, chef and assistant, two waiters, an oiler, the watchman and steward. The two boilers and engine, together with the auxiliaries, take up the space from frame No. 26 to No. 55. The space from frame No. 55 to No. 66 is occupied by fourteen people, including the chief engineer, assistant engineer and electrician. All berths are of metal, while the quarters are finished in redwood.

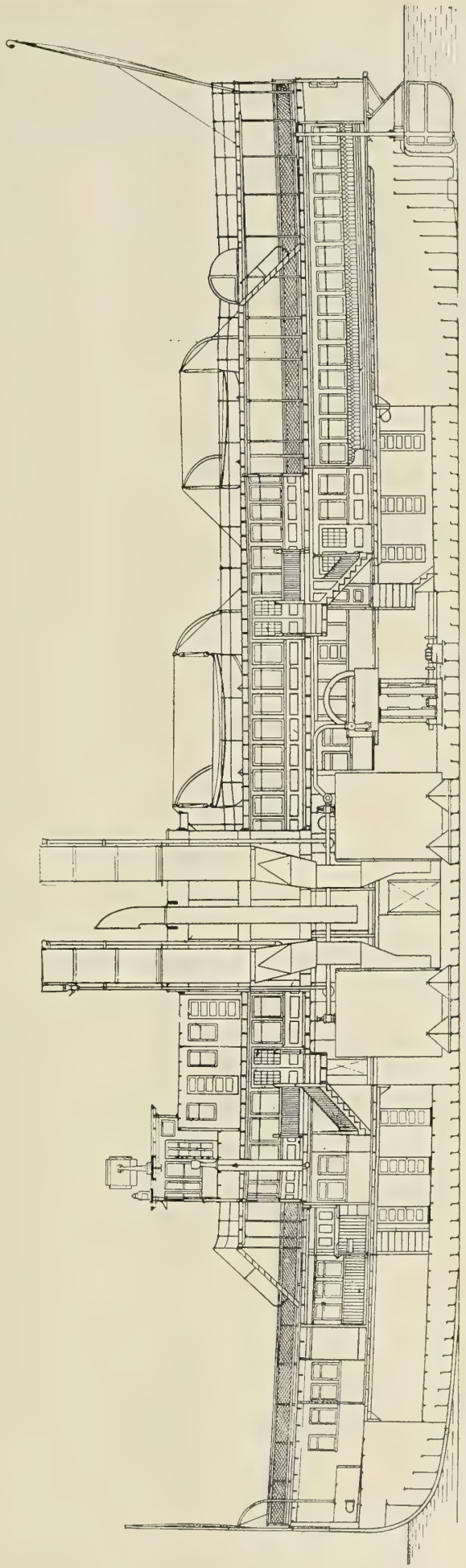
On the main deck a hand-capstan windlass occupies the space as far aft as frame No. 7. From frame No. 7 to No. 12

space is taken up by the men's toilet, which is finished in redwood. The bar-room is finished in chestnut, and leads as far aft as frame No. 19. Access to the toilet and bar-room is maintained by a 3-foot passage extending along the port side of the ship forward from frame No. 19 and terminating in the windlass room. This passage is finished in oak. The deck from frame No. 19 to No. 43 is clear, with the exception of the boiler casing, which is 14 feet wide and extends from frame No. 26 aft to No. 44. The upper part of the boiler casing forward is cut away to make room for the stairs leading from the promenade to the main deck. The forward gangways extend on each side of the ship from frame No. 22 to No. 25. This part of the ship is finished in oak. The ship is coaled through five 20-inch diameter scuttles placed between frames No. 26 to No. 42. The starboard side of the ship from frame No. 43 to No. 54 is taken up by the galley, which extends from the ship's side to the engine-hatch coaming. A passage is left between the galley and boiler casing to connect with an athwartship passage between the forward engine-hatch coaming and the after boiler casing, making a clear passage from port to starboard of 42 inches wide. This passage, in turn, connects with a fore and aft passage on the port side leading from the main deck amidships to the social hall aft. The ladies' lavatory on the port side, extending from frame No. 43 to No. 56, communicates with this passage. The engine hatch is 13 feet wide and extends from frame No. 46 aft to No. 54. The social hall, extending from frame No. 54 to No. 62, includes the stairs leading from the main to the promenade deck, while gangways take up the space from frame No. 56 to No. 59. The breakfast room, extending from frame No. 62 aft to the stern, includes the linen room on the starboard side and the purser's room on the port. The breakfast room is finished in quartered oak, and contains twenty tables with redwood tops. The purser's room, linen room, galley and ladies' lavatory are finished in redwood, while the social hall is finished in mahogany.

The promenade deck extends from stern to stern, and is clear but for a closed cabin 19 feet wide which extends from frame No. 19 to No. 62. The forward end of this cabin contains the stairs leading to the main deck, while a stack casing, 7 feet 6 inches wide, extends from frame No. 31 to No. 41. The after end of the cabin is taken up by stairs leading to the social hall on the main deck and by a souvenir counter placed in the extreme end. The deck is supported amidships by the boiler casing, which in turn is given additional strength.

Forward and aft of the boiler casing I-beam stringers in connection with gas-pipe stanchions are used in giving support to the deck, while the space between the promenade and main deck is built up of wood. The deck itself is of 7/8-inch pine covered with canvas, and supported by 4¾-inch by 1⅞-inch pine beams spaced 24 inches center to center. The deck is enclosed by a railing, consisting of an oak rail 1¾ inches by 5 inches, supported at equal intervals by oak stanchions, the whole being enclosed by galvanized wire iron work. Window stools and the sash of cabin windows are of mahogany, while the cabin exterior is finished in redwood and the interior is finished in white pine covered with white enamel. The souvenir stand is of mahogany, together with the newel posts of stairways and the wood finish around the pipe stanchions.

The boat deck extends from frame No. 17 aft to the extreme stern. The deck forward carries the usual pilot house and chart room, together with accommodations for the captain, owner, maid and mate. The stack casing, 7 feet 6 inches wide, extends from frame No. 31 to No. 41. Aft of frame No. 42 there are four lifeboats. The stairs leading to the promenade deck are located between frame No. 72 and No. 75. The entire deck is enclosed by a ¾-inch pipe railing about 2 feet 9 inches above the deck, supported by ¾-inch pipe

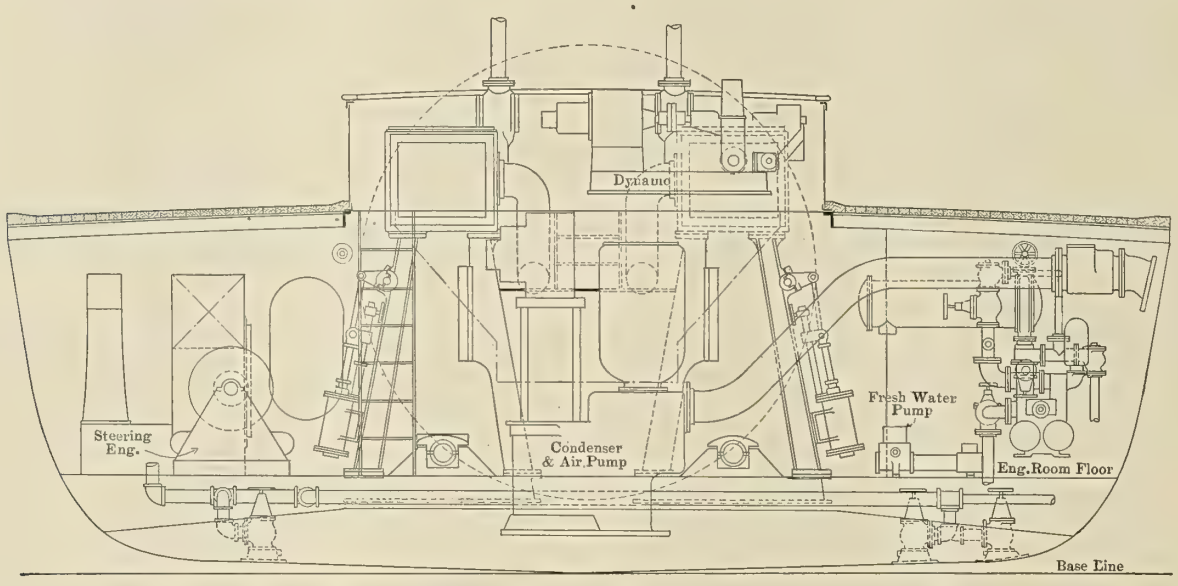


INBOARD PROFILE OF THOUSAND ISLANDER

stanchions placed at 5-foot intervals. The support for the deck is arranged for in the same manner as the promenade deck. The deck is of ⅞-inch pine covered with canvas. The beams are of pine, 1⅜ inches by 4¾ inches, spaced 25 inches center to center, the camber being 6½ inches in 32 feet. The texas is finished in redwood, while the sash for the windows is of mahogany.

HULL

The steel hull is divided into six compartments by transverse bulkheads, three being watertight and two non-watertight. The peak bulkhead at frame No. 6 is made up of 10-inch plate, stiffened in a vertical direction by 3½-inch by 2½-inch by 6.1-pound angles, and in a horizontal direction by 2½-inch by 2½-inch by 4.1-pound angles. The plating of watertight bulkheads at No. 26 and No. 66 runs from 12½ pounds below to 6 pounds above. Horizontal and vertical stiffeners are all 2½ inches by 2½ inches by 4.1 pounds. The bulkhead at frame No. 44 is non-watertight and separates the boiler from the engine space. It is built up of 6-pound plate stiffened vertically by 2½-inch by 2½-inch by 4.1-pound angles, and horizontally by 3½-inch by 2½-inch by 7.2-inch angles. The engine space is separated from the after hold by a non-watertight bulkhead at frame No. 55. It is built up of No. 14 B. W. G. plate, and stiffened vertically and horizontally by 2½-inch by 2½-inch by 4.1-pound angles. Double angles are used in connecting the watertight bulkheads to the shell, while single angles are used for those that are non-watertight. Diamond-shaped liners are fitted to all bulkheads in way of outside strakes of plating. There are two coal bunkers, placed on opposite sides of the ship, and having doors that open into the fire-hold. The starboard bunker extends from frame No. 36 to No. 44, and the port bunker from No. 26 to No. 35. The bunkers are built up of 6-pound plate, stiffened vertically by 2½-inch by 2½-inch by 4.1-pound angles spaced 24 inches heel to heel. The boiler casing consists of 6-pound flanged plate built up from 10-pound coamings. The plates are flanged the necessary depth to do away with the angle stiffeners. The shell plating includes the garboard strake of 11 pounds fore and aft, bilge and bottom plate 10 pounds fore and aft. Strake next below the sheer strake 11 pounds fore and aft, while the sheer strake is 12 pounds for two-thirds length amidships reduced to 11 pounds at the ends. The keel plate is flat, being 30 inches wide by 15 pounds fore and aft, and worked in lengths of not less than seven-frame spaces. The butts are double riveted; a single inside 18-pound strap being fitted extending to the garboard edge laps. The garboard, bottom and bilge strakes are butt lapped, double riveted, ⅝-inch rivets being used. The side and sheer strakes are butt lapped, double riveted, ¾-inch rivets being used. The fore and aft edge laps of the garboard and sheer strakes are double riveted, the remainder are single riveted. The underbody of the boat is sheathed with rock elm, 2½ inches thick. The sheathing extends from between frames Nos. 15 and 16 to frames Nos. 66 and 67, and extends upward to the turn of the bilge. After the shell plating had been calked the wood sheathing was fastened in place by means of bolts and nuts and the bottom was then calked in the usual manner. The floors, 12 inches deep, are solid on every frame, being formed of 10-pound plates with the exception of the engine and boiler space, where they are increased to 14 pounds. Deep floors are provided for the engine space and also for the ends of the ship. The frames are formed of 3-inch by 2½-inch by 4.5-pound angles and spaced 24 inches heel to heel. The reverse frames forward and aft of the engine and boiler space are 2½-inch by 2½-inch by 4.1-pound angles, extending alternately to the main deck stringer plate and to the upper turn of the bilge. In the engine and boiler space they are increased to 5 pounds, and all extend to the main deck stringer plate, while additional reverse frames are fitted for the length of the floors.



SECTION THROUGH THE ENGINE ROOM

There are two longitudinal keelsons on each side of the center line, worked intercostal between solid floors on each frame. The longitudinals are formed of 10-pound vertical plates, whose lower edge is flanged and riveted to the shell, while the top edge is riveted to a 6-inch by 10.5-pound channel, which extends fore and aft over the tops of the floors, to which it is attached by angle clips.

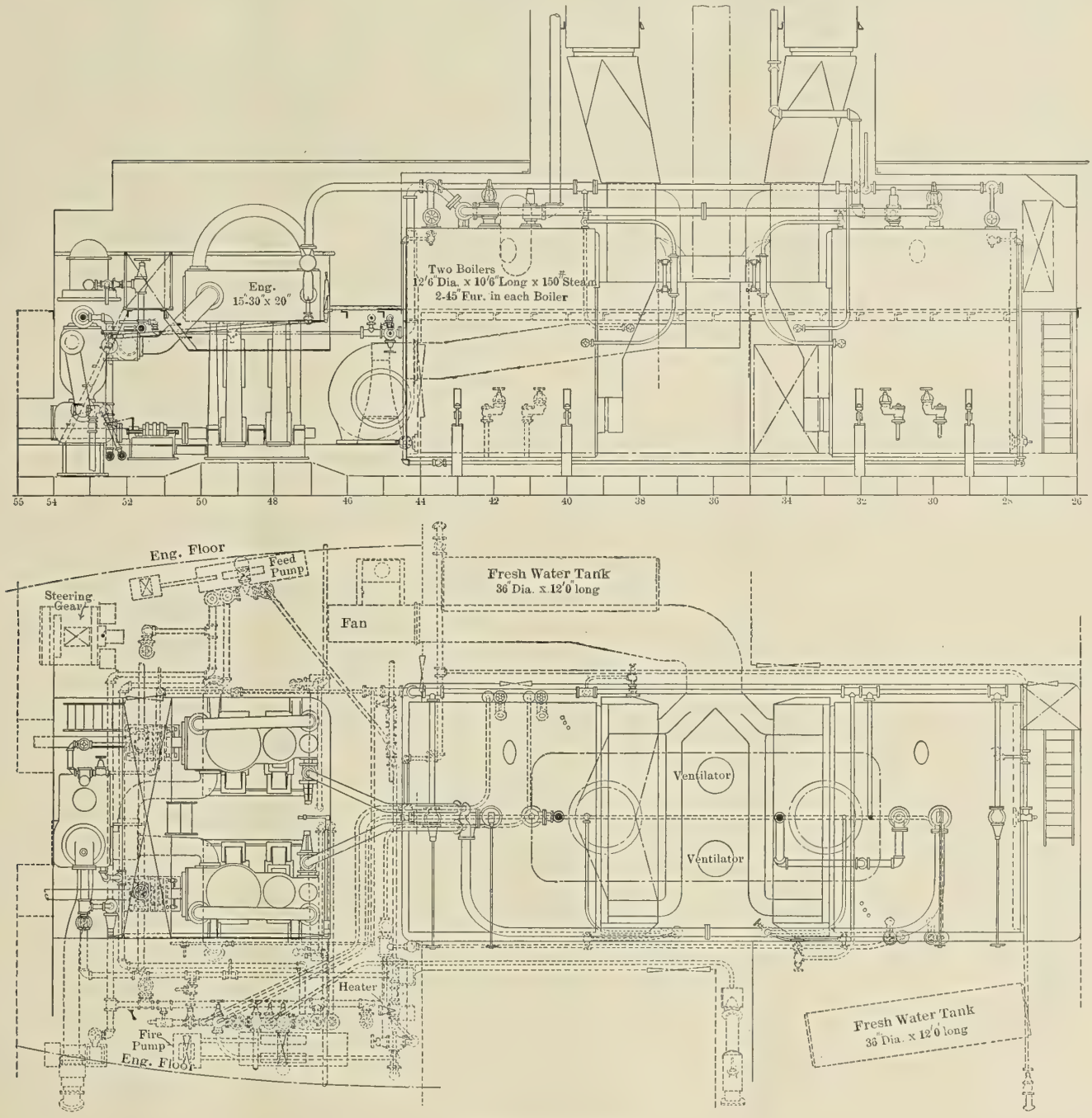
The channels are continuous fore and aft, and are not cut in the way of bulkheads. Bracket connections are made at all bulkheads, besides the necessary watertight construction. The longitudinals are carried as far forward as practicable and as far aft as the stern, where they help to stiffen the roof of the tunnel.

The bilge and side stringers are formed of a 6-inch by 10.5-pound channel, connected to the frames by 2½-inch by 2½-inch by 4.1-pound clips. The channels are slotted in way of the frames and cut at the bulkheads, to which they are attached by suitable brackets. The outer flange of the channel is connected directly to the shell, while the channel itself is fastened

to the frames by angle clips. At the stem the stringers are connected by 10-pound plate breast hooks, together with the necessary angles.

The foundation for the engines is formed mainly of four longitudinal girder plates, each of 10-pound intercostal between the floors, to which they are attached by means of double angles 2½ inches by 2½ inches by 4.1 pounds. The

The main deck beams are of angle steel, 5 inches by 3 inches by 8.2 pounds, placed on every frame, to which they are connected by 10-pound gusset plates 15 inches by 15 inches. The camber is 6 inches in 32 feet. The main deck stringer plates are 18 inches by 10 pounds for two-thirds length amidships, reduced to 8 pounds at the ends. They are fitted close to the sheer strake plating, and connected thereto by a 6-inch by



MACHINERY ARRANGEMENT

girder plate itself extends to the shell, to which it is connected thereto. The rider plates are continuous, and formed of 20-pound plates 15¾ inches wide, connected to the floor plates and longitudinals, thereby tying the whole together.

There are two saddles for each boiler, consisting of 14-pound plate and double angles 3 inches by 3 inches by 7.2 pounds. The fore and aft saddles for each boiler are connected by 14-pound plate girders, to which they are connected by 2½-inch by 2½-inch by 5-inch angles.

14.52-pound Z-bar. The top edge of the sheer strake is flanged outward to receive the lower flange of the Z-bar, while the deck stringer is connected to the upper flange of the bar.

The only plating on the main deck, other than that of the main deck stringer, is that due to the reinforcement of hatch openings in the way of boiler and engine space and stairways. The main deck is of pitch pine, 2¼ inches thick by 3¾ inches wide, laid in long lengths, and well fastened to the beams and plating by ½-inch diameter cheese head, square necked,

galvanized bolts and nuts. An oak fender strake, 6 inches by 8 inches, is placed on a line with the main deck and extends around the stern to as far forward as the stem.

MAIN ENGINES

There are two main engines of the two-cylinder, vertical, direct-acting compound type, well balanced, and each capable of developing about 500 indicated horsepower at 200 revolutions per minute, from a steam pressure of 150 pounds per square inch. The sequence of cylinders, beginning forward, is high-pressure and low-pressure, with diameters, respectively, 15 inches and 30 inches and a common stroke of 20 inches.

The main engines are placed 8 feet apart in a single engine room without a center line bulkhead, the starting platform being very conveniently located between the engines, with ample space for the engine crew to work in. The cylinders are fitted with safety valves in the bottom and covers. From the center of the engines to the center of propeller is 62 feet 6 inches. The cranks are set at 90 degrees. The high-pressure cylinder has one piston valve, 9 inches in diameter, while the low-pressure cylinder has a flat, double-ported slide valve, 28 inches wide and 24 inches long, the valve travel in each case being 4¼ inches.

The valves are operated by Stephenson's link motion through overhung double-bar links, whose motion is derived from eccentrics keyed to the crankshaft. The valve gear is so adjusted that the mean cut-off in full gear will be about 66¾ percent in the high-pressure cylinder and 56¼ percent in the low-pressure cylinder. The point of cut-off will be variable by means of slotted reverse arms. The pins on the links for the attachment of the eccentric rods are 24¼ inches center to center, the full throw of the links being 12 inches. The high-pressure eccentric sheaves are of cast iron and made in one piece, while the low-pressure sheaves are made in halves. The straps for all the eccentrics are of cast iron and made in halves, the bearing surface in each being 2¼ inches wide. The distance from the center of the shaft to the center of the links is 50½ inches. The valve stems in all cases are 1½ inches in diameter through the valves, 2 inches in diameter through the stuffing boxes and 2¼ inches at the guides. The piston rods are each 3¼ inches diameter.

The framing of each engine consists of two cast iron I-section columns at the front and two cast iron box section columns at the back. The bed plates are of cast iron and contain three bearings each. The exhaust passage from the high to the low-pressure cylinder is formed by an 8-inch extra heavy steel pipe, bent to the arc of a circle and connected by means of flanges to the upper facing of the steam chests, as illustrated in the general arrangement of the engine. From the inboard side of each low-pressure steam chest a steel exhaust pipe leads to a cast iron fitting bolted directly to the condenser, which is common for both engines. Each exhaust pipe has a diameter of 11 inches at the cylinder and 12 inches at the condenser.

The high-pressure pistons are of cast iron fitted with cast iron plugs arranged for water grooves. The low-pressure pistons are of cast steel fitted with the usual arrangement of cast iron follower and two spring rings in each piston. All pistons have a depth of 4½ inches.

The crossheads are of cast steel with pins 4 inches in diameter by 5½ inches long. Brass slippers are fitted for both ahead and astern thrusts. The slipper for the ahead thrust is 10 inches wide by 12 inches long, while the combined width of the slipper for the astern thrust is 6 inches with a length of 12 inches. The crosshead backing guides of L-section are made of cast iron and bolted directly to the back columns.

The connecting rods, which are 45 inches center to center, have a diameter at the crosshead end of 3¾ inches and 3¾ inches at the crank end. The crosshead end has a single connection, and the adjustment for wear at that end is taken up by means of a wedge, while at the crank end a bolt connection is used.

The crankshafts are each made in one forging with a coupling disk 14½ inches diameter by 1⅞ inches thick at one end. The length over all is 7 feet 1½ inches. The journals are 6¾ inches diameter, while the crank pins are 6¾ inches diameter by 8 inches long.

The crank webs are 7¾ inches wide by 4¾ inches thick. Opposite each crank slab a tail piece is forged, to which the cast iron counter-balances are bolted. The counter-balances are of sufficient weight to take care of the reciprocating as well as the rotating weights. Each thrust shaft is 6¾ inches diameter and 37 inches over all, being fitted with four collars 13 inches diameter by 1⅜ inches thick and 3½ inches apart. A coupling disk is forged on each end 14½ inches diameter by 1⅞ inches thick.

There are two intermediate shafts for each engine, 6¾ inches diameter by 12 feet 9¼ inches long, and coupling disks forged at each end. The tail shaft is 7¼ inches diameter in the bearings and 6¾ inches diameter between the bearings and at the ends. Length over all is 30 feet 3 5/16 inches. A cast iron coupling disk, 18¾ inches diameter, is shrunk on the forward end.

Each crankshaft has three bearings 6¾ inches diameter, two being 8 inches long and one 11¾ inches. The thrust bearings consist of cast iron pedestals fitted with three cast iron horseshoe collars lined with white metal in each pedestal. The intermediate shafting for each engine will be carried by two spring bearings made of cast iron, the lower halves being lined with white metal. Each propeller shaft will be supported at the outboard strut and also in the stern tube by a bearing at each end. The bearing in the strut will consist of a brass sleeve 22 inches long carrying wood strips of lignum vitæ. The after bearing in the stern tube is a duplicate of the strut bearing, while the bearing at the inboard end consists of a brass sleeve.

The stern tube is made of two cast iron sleeves connected by a standard steel pipe 9 inches diameter. The after sleeve is made to fit a cast steel boss riveted to the shell of the ship, while the inboard end is flanged to receive the after collision bulkhead. The over-all length of stern tube is 14 feet 5 inches.

There are two propellers of cast iron, solid, three-bladed, and made to the right and left hand. The diameter of each wheel is 6 feet, while the pitch is 9 feet, and the developed area for one wheel is 14½ square feet. The propellers rotate outboard.

AUXILIARY MACHINERY

All auxiliary machinry is placed below the main deck with the exception of the dynamo and hand deck pump, which are placed on the main deck.

Reversing Gear—A steam cylinder, 7 inches diameter and 12 inches stroke, is used for reversing each engine, and is bolted directly to their respective front columns. A slide valve of cast iron governs the action of this cylinder.

Air Pump and Jet Condenser—A single-acting, independent, vertical air pump and jet condenser is fitted, having one steam cylinder 12 inches diameter placed directly over the air chamber, 24 inches diameter, with a common stroke of 18 inches. The diameter of the injection pipe is 5 inches, while the overboard discharge pipe of the air pump is 10 inches. All independent pumps are furnished by the Dean Bros. Company, Indianapolis, Ind. The air pump is placed athwartship, the center being 9 feet 5 inches aft of the center of the engine, the base resting upon the ship floors.

Feed-Water Heater—The feed-water heater is located on the starboard side on the forward engine room bulkhead, and

uses the auxiliary exhaust steam. This heater is a No. 5 Schutte & Köerting film feed-water heater, consisting of eight spirally corrugated tubes, 2⅜ inches diameter by 46 inches long.

Feed Pump—There is one 10-inch by 6½-inch by 12-inch independent, simplex, plunger, horizontal feed pump. It is located on the port side of the engine room, and has a discharge of 2½ inches diameter, while the suction connects with a 4-inch two-valve manifold, which draws from the hotwell and sea.

General Service Pump—There is one 8-inch by 5-inch by 12-inch independent, duplex, plunger, horizontal general service pump placed on the starboard side of the ship. The suction of this pump is connected to a 4-inch three-valve manifold, which draws from the sea, bilge and hotwell. The discharge, 2½ inches diameter, is connected to the general service pump manifold, through which the pump discharges indirectly to the ash gun, fire hose, deck hose, engine hose, condenser, overboard, fresh-water tanks, to the boilers through the feed-water heater and to the boiler direct through independent lines. A No. 14½ Model O Metropolitan injector discharges into the after end of this manifold.

Fresh-Water Pump—There is one 4-inch by 3¾-inch by 5-inch independent, duplex, piston, horizontal fresh-water pump placed on the starboard side of the ship on the forward engine-room bulkhead. The suction and discharge are, respectively, 2 inches and 1½ inches. The suction and discharge are connected to the fresh-water tanks, which are placed in the boiler room.

Sanitary Pump—There is one 5½-inch by 5-inch by 5-inch independent, duplex, piston, horizontal sanitary pump placed on the starboard side of the ship, and whose suction is taken from the sea. The suction and discharge are, respectively, 3 inches and 2 inches.

Bilge Pumps—There are two independent, horizontal, plunger bilge pumps, 4½ inches diameter by 4 inches stroke, each pump deriving its motion from a pin driven into the forward end of the crankshaft. The pump body is bolted to the outboard side of the bed plate of each engine, the suction, 3 inches diameter, is connected to the bilge, while the water is discharged through 2½-inch pipes directly overboard.

Steering Engine—There is a double-cylinder 5-inch by 5½-inch steering engine, steam and hand combined, made by the Hyde Windlass Company, Bath, Me., and placed on the port side of the ship, connecting with the rudder quadrant by means of chains.

Dynamo—There is a 25-kilowatt Crocker-Wheeler generator direct connected to a Terry steam turbine, which furnishes current for lighting the ship. This outfit is placed on the main deck, starboard side, just off the engine platform. The switchboard is placed on the port side near the entrance to the engine platform, the whole being within the engine well.

The distribution of lights is as follows:

Boat Deck—Ten 8-candlepower, five 16-candlepower, four 32-candlepower signal lights.

Main Deck—Fifty-seven 8-candlepower, forty-five 16-candlepower.

Promenade Deck—Seventy-nine 8-candlepower, eight 16-candlepower.

Hold—Thirty-seven 8-candlepower, thirty-six 16-candlepower.

Fan and Engine—The fan and engine used in connection with the forced draft for the boilers is placed on the port side of the engine room at the forward engine-room bulkhead. The 5-inch by 5-inch high-pressure engine is direct connected to a No. 6 Sirocco fan, both being furnished by the American Blower Company, of Detroit, Mich.

Ash Gun—The ash gun is placed at the starboard side of the ship on the forward side of the coal bunker bulkhead. This gun consists of the hopper into which the ashes are thrown, and there discharged overboard through a 7-inch extra heavy pipe, check valve and deflector, which is riveted to the side of the ship. A water jet at the top and bottom of the gun furnishes the necessary power to discharge the ashes.

Hand Pump—There is one vertical, duplex, plunger hand pump, required by the United States laws, placed on the main deck aft. Each cylinder is 4¾ inches diameter, with a stroke of 6 inches, making a total capacity for each cylinder 106 cubic inches.

Boilers

Two single-ended Scotch boilers of the cylindrical type, working at a pressure of 150 pounds to the square inch, are located on the center line of the ship in one boiler room. The distance apart of the boilers longitudinally is 9 feet 9 inches between the furnace fronts, while each boiler has a separate funnel spaced 12 feet apart. The funnels are 40 inches inside diameter, while the outside stack is 48 inches diameter, the top being 40 feet 3 inches above the grates. The boiler aft projects through the bulkhead between the boilers and engines about 3 inches. There is an exit to the main deck at the forward end of the boiler room. Ventilation for the boiler room is provided by two 24-inch ventilators placed in the center of the boiler room, and whose outlets are carried down to a height level with the bottom of the air heater.

The furnaces, two in each boiler, have internal and maximum diameters of 45 inches and 48 15/16 inches, respectively, the thickness being 15/32 inch. The grates are 5 feet 6 inches long, the grate surface of each boiler being 41¼ square feet, while the heating surface in each boiler is 1,713 square feet, or a ratio of 41.5 to 1, making for the two boilers an aggregate grate surface of 82.5 square feet and a total heating surface of 3,426 square feet. The furnaces are of the Morison suspension type, and have independent combustion chambers. The length of the tubes between the tube sheets is 6 feet 10 3/16 inches, and they are spaced 3½ inches in a vertical and 3¾ inches in a horizontal direction. Each boiler contains 326 tubes, of which forty-four are stay tubes; all have an outside diameter of 2½ inches, with a thickness of No. 10 for the stay tubes and No. 12 for the ordinary tubes. The tube sheets have a thickness of ⅝ inch. The top of the combustion chamber, which is 9/16 inch thick, is supported in the usual manner by bridge girders. The boiler shell is 15/16 inch thick.

The positive forced draft unit consists of a No. 6 Sirocco fan, direct connected to a 5-inch by 5-inch high-pressure engine, the whole being furnished by the American Blower Company, Detroit, Mich. The suction of the fan is taken from the engine room, while the air is discharged through a 24-inch by 24-inch galvanized steel pipe to the air heaters, which are studded to the boiler fronts. The suction of the fan has a diameter of 31¾ inches, while the discharge has a sectional area of 576 square inches. The air heater for each boiler measures 9 feet long by 2 feet 8 inches wide and 5 feet 2 inches deep. Each heater consists of 127 horizontal tubes, whose ends are expanded into steel plate headers, ¼ inch thick. All the tubes are of steel, 2¼ inches outside diameter, No. 14 gage, and 9 feet long. The total heating surface for both air heaters is 1,346 square feet. The operation of the positive draft is such that the burnt gases from the boiler pass by on the outside of the air-heating tubes, while the fresh air for the furnaces is forced through the tubes, thus abstracting heat from the boiler gases for the benefit of combustion.

Correction.—On page 396 of the October issue it was erroneously stated that the Diesel-engined Standard Oil barge *No. 62* made a trip from New York to Providence, R. I., in 11 hours. The correct time was 23 hours.

The First of the Eight New American-Hawaiian Steamers

In anticipation of additional business after the opening of the Panama Canal, the American-Hawaiian Steamship Company of New York has placed with the Maryland Steel Company, Sparrows Point, Md., an order for eight ships similar in character to the *Kentuckian* and *Georgian* (see Vol. XV, page 399) now in service. The placing of such a large order with one firm is unprecedented in the annals of American shipbuilding.

The route on which these vessels are to be placed is from New York to San Francisco and the Hawaiian Islands by way of the Panama Canal. Special attention has been paid to the arrangement of hatches for shipping large timbers. After the Canal has been opened to the marine traffic of the world, the owners will insulate the upper 'tween decks for the purpose of carrying tropical fruits, the builders having created a suitable steel house on the shelter deck ready for the installation of the refrigerating machinery.

The owners specified one radical departure from their previous boats. They desired to take advantage of the decrease in weight that the longitudinal system of framing allows and thereby increase the earning power of the ships. All eight vessels are to be built on the Isherwood system, the company also recognizing the advantages gained by clearer holds, besides increased dead weight.

The *Minnesotan*, the first of the order to be launched, made her initial trip down the ways on June 8, followed by the *Dakotan* on August 10. The *Minnesotan* went on the builders' trial on September 10 and left the following day for New York to be delivered. The principal dimensions of these boats are: Length between perpendiculars, 414 feet 2 inches; beam molded, 53 feet 6 inches; depth molded to shelter deck, 39 feet 6 inches; depth molded to upper deck, 31 feet 6 inches. The vessels are built to the highest requirements of Lloyds under special survey and are classed 100 A-1. The ships will carry 9,450 tons of dead weight on a draft of 28 feet and maintain a service speed of 12 knots.

All have straight stems, elliptical sterns, three continuous steel decks with an additional steel orlop deck in No. 1 hold. The propelling machinery is located amidship, just forward of which is a deep tank with an oiltight center line bulkhead for carrying either coal, cargo or fuel oil. At each end of the ship is located a peak tank for carrying fuel oil or water ballast. The double bottom extends the entire length of the boat with an oil-tight center keelson, and is divided longitudinally into eight tanks, the three under the machinery space being intended for carrying feed water. Oil wells are built in to separate these tanks from the remainder, which are to be used for fuel oil or water ballast.

When it is decided to use coal instead of fuel oil in the boilers, the coal will be carried in a bunker on the second deck abreast the machinery space and in the deep tank. The combined bunkers have a capacity of 900 tons. A steel shaft alley is built in the two after holds, extending from the machinery space to the after peak bulkhead. The ship's stores are carried at each end of the second deck over the peak tanks.

The vessels are fore and aft schooner rigged, with two steel masts and four king posts. The masts have eight booms each, one on the foremast being of 30-ton and one on the mainmast of 20 tons capacity. All other booms are capable of handling 5 tons. Each forward king post is fitted with two booms and the after ones with one each; the king post booms are of 3 tons capacity. All cargo booms are of seamless steel tubing imported from the Mannesmann Tube Works, Dusseldorf. To facilitate the handling of freight, four cargo ports are fitted to the lower 'tween decks and six to the upper 'tween decks. On each deck are six large hatches with wooden covers, and in addition numerous small trimming hatches are distributed throughout on the upper and second decks.

The deck machinery is composed of a Hyde vertical wildcat pattern steam windlass with the engine on the deck below. Warping heads are fitted above the wildcats. Four double-geared and ten single-geared winches with single drums and gypsy heads are installed for handling freight; the winches have 9-inch by 14-inch double cylinders. Two heavy steam dock capstans with 9-inch by 9-inch cylinders are also fitted on deck, one forward and one aft. The steering engine is a Hyde geared quadrant type operated by means of a Brown telemotor from the pilot house, the flying bridge and the steering engine room. The engines are twin vertical engines, each capable of handling the rudder under any condition. The deck equipment consists of two 26-foot metallic lifeboats, one wooden 20-foot cutter and one wooden 22-foot gig. All boat davits are Norton's patented screw gear type.

The accommodations for the passengers, officers and crew are large and airy, the aim being to make the quarters as comfortable as possible, as a considerable portion of each trip is in the tropics. The quartermasters, carpenter and boatswain are quartered in the forward end of upper 'tween decks. Their stores, lamp room, wash and toilet room are forward. At the after end of the upper 'tween deck the watertenders, oilers, seamen, firemen, wash and toilet rooms are installed.

The midship house contains the dining saloon and pantry, the officers' mess room and pantry, two spare staterooms, store rooms, accommodation for the freight clerk, cooks, steward, mess boys, chief, first, second, third, deck and refrigerating engineers, and bath and wash rooms. In a steel house at the after end of the shelter deck the hospital with bath and spare staterooms are fitted.

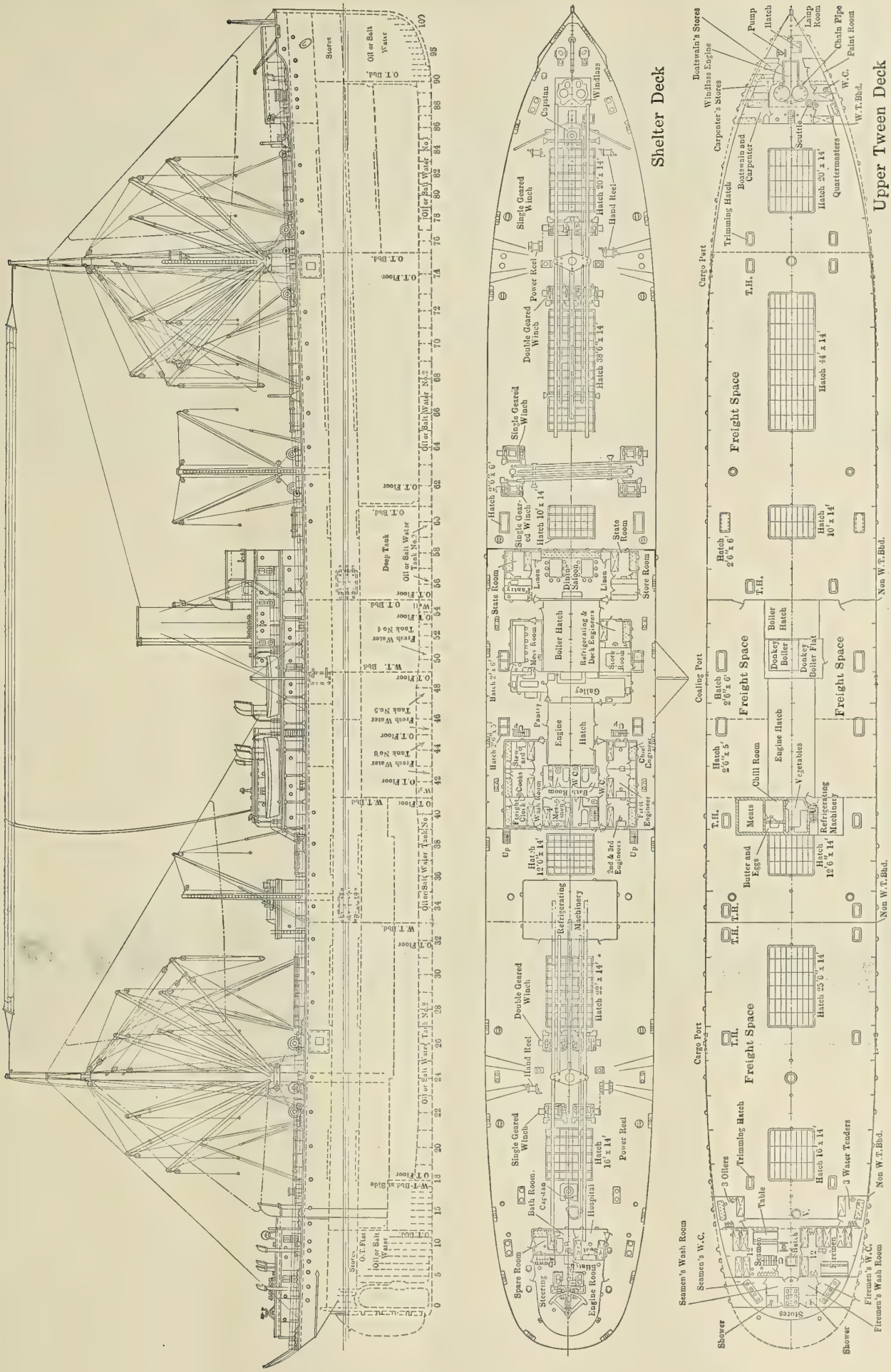
On the boat deck are located four staterooms and bath, the wireless room, pilot house, chart room, first, second and third officers, officers' bath and the captain's stateroom, office and bathroom. At each of the lower 'tween decks special freight rooms are bulkheaded off for bonded freight.

The propelling machinery in the *Minnesotan* is similar in design to that installed in the steamers *Kentuckian, Georgian* and *Honolulan,* and consists of one 4-cylinder quadruple expansion engine, three single-end Scotch type boilers and the necessary auxiliaries.

The main engine cylinders are 25½ inches, 37 inches, 53½ inches and 76 inches in diameter by 54-inch stroke, having piston valves throughout, and are supported by heavy box columns fitted with double slipper guides. The main air pump, two bilge pumps and an oil pump for forced lubrication to thrust block, are attached to the high-pressure engine. The crank shaft is 15¼ inches in diameter and is in four interchangeable pieces, the cranks being set at equal angles.

The propeller, which is 15 feet 6 inches diameter by 18 feet 6 inches mean pitch, has a cast steel hub with manganese bronze blades. The main boilers are 16 feet mean diameter by 12 feet 3 inches long, designed to meet the requirements of Lloyd's inspection rules for 215 pounds working pressure. Each boiler contains four 41-inch inside diameter corrugated furnaces. The tubes are 2¾-inch diameter and the total heating surface is 3,173 square feet per boiler.

The boilers extend through the engine room bulkhead and have all connections on the back heads in the engine room. They are fitted with the Howden's system of forced draft and are built to burn either oil or coal as fuel. It is the intention to burn oil for the greater part of the time, but all the necessary grate bars, etc., are carried so that the change



GENERAL ARRANGEMENT PLANS OF THE AMERICAN-HAWAIIAN STEAMSHIP MINNESOTAN

to coal may be made at any time. When burning oil the steam atomization system is used with the necessary pumps, oil heaters and filters, etc., carried on the forward fire-room bulkhead. The fuel oil system throughout is furnished in duplicate. The donkey boiler is 10 feet diameter by 9 feet 6 inches long, built for 315 pounds per square inch working pressure and to burn either coal or oil fuel.

There are also provided two long-stroke simplex feed pumps, a duplex fire and bilge pump, an oil trim pump, a duplex ballast pump, a fresh water pump, an auxiliary condenser with attached air and circulating pumps for port use, a 14-inch centrifugal circulating pump, two 20-ton evaporators with pump, two distillers with pump and serrating tank, a forced draft blower, a 2-ton refrigerating plant and a multi-coil feed heater. A drill press, a lathe and an emory wheel are installed on the starboard side in the engine room and are operated by an electric motor.

A system of mechanical ventilation for the cargo holds has been installed with two motor-driven fans located in the engine casing.

An Installation of Fire Extinguishing and Fumigating Apparatus

One of the few menaces to safety on board ship at sea which has not been entirely overcome in modern steamship construction is the danger of fire. In spite of the careful consideration which is usually given to fireproof construction instances are not infrequent where enormous losses of property and sometimes of life occur from this cause, and the difficulties of fighting fire in the hold of a ship laden with an inflammable cargo are clearly recognized by experienced seamen and marine engineers. Fire has been known to smoulder for days and weeks in a ship's hold while the crew has been unable to check it, and even when checked the ordinary means of fighting fire at sea invariably damage such of the cargo as is not destroyed by the fire itself. Water and steam are the common weapons used for this purpose, but a cargo hold can seldom be flooded with water without impairing the safety of the vessel, and the use of steam has not proved as effective in practice as it would appear to be in theory. These facts are conceded by experienced fire fighters.

On the other hand, the value of sulphur dioxide gas as a fire extinguisher has been known to engineers and scientists for many years, and the efficiency of the same gas for fumigating purposes has been admitted by the best authorities for over 2,000 years. The generation and application of this gas, therefore, have been the subject of study and experiment for generations, the object being to produce it in volume so that it can be delivered in quantities sufficient to do its work without damaging the things with which it comes in contact. This, it is claimed, has been accomplished by a machine known as the "Grimm" sulphur dioxide gas machine, manufactured by the Fumigating & Fire Extinguishing Company of America, New York. A detailed description of this machine was published on page 125 of the March, 1912, issue of International Marine Engineering, and it will be remembered that by this method commercial sulphur, or "rolled brimstone," as it is known to the trade, is put into a furnace into which the air is forced in such quantities as to form perfect combustion, the continuance of which is dependent only upon the periodical supply of sulphur, which is accomplished by means of a patented device on top of the machine through which no sulphur fumes can escape. This furnace is placed inside a water-jacket of rectangular form, constructed in the manner of a marine boiler, through which water is circulated during its operation. The gas is forced from the "dome" of the furnace by its elasticity, and after passing through cooling tubes in the water-jacket is then discharged from the machine in a cool and dry condition, whence it is conveyed through a pipe or hose to its destination. Such, briefly, is the operation of the apparatus.

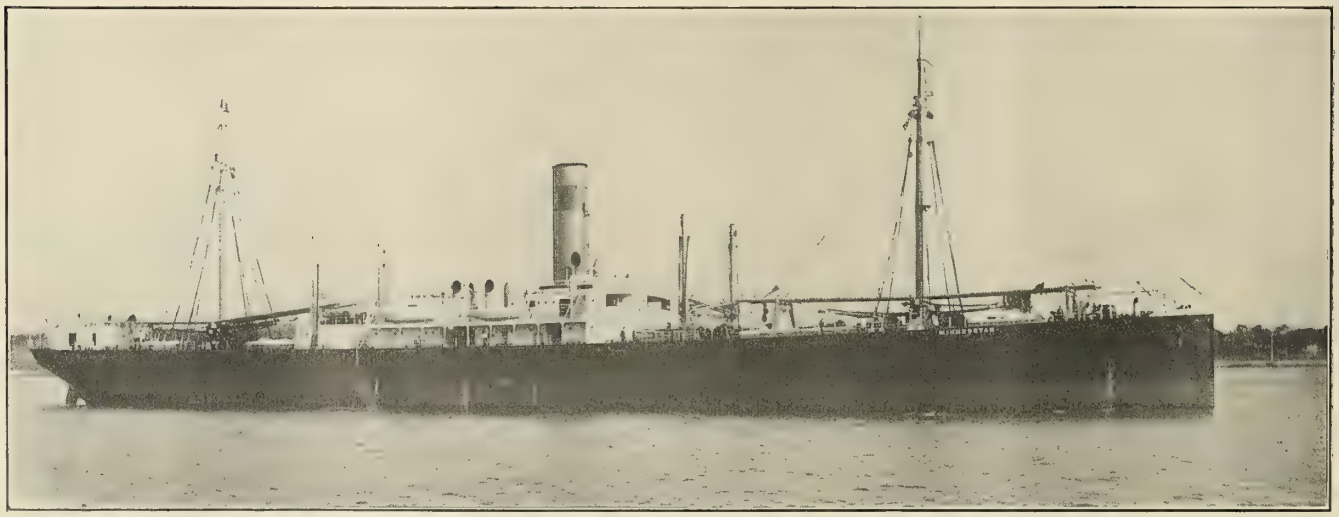


FIG. 1.—NEW AMERICAN-HAWAIIAN STEAMSHIP MINNESOTAN

Its value to a steamship owner is clearly evident when it is realized that the gas thus generated will extinguish fire without damage to cargo. At the same time the installation of this apparatus on a steamship insures the vessel a clean "bill of health" the world over; for not only is the ship protected against fire by turning the gas into any compart-

ment or hold where a fire may occur, but the entire ship, or any part of it, can be effectually fumigated without recourse to the makeshift apparatus supplied by quarantine officers, most of which is obsolete. The operation of this apparatus has shown by experience to be capable of entirely freeing a

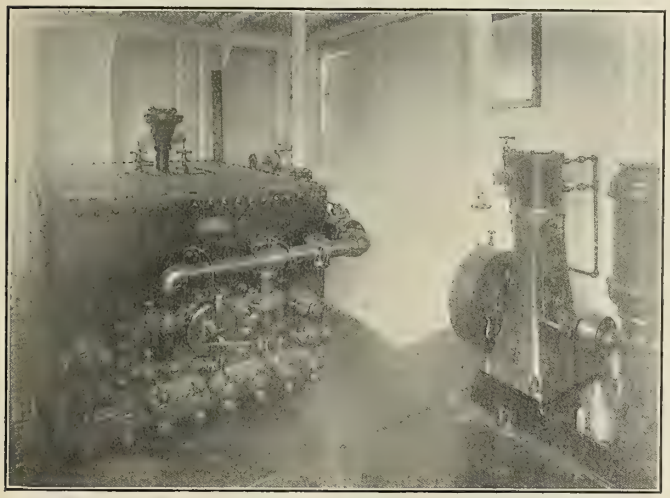


FIG. 2.—FUMIGATING AND FIRE EXTINGUISHING APPARATUS ON THE MINNESOTAN

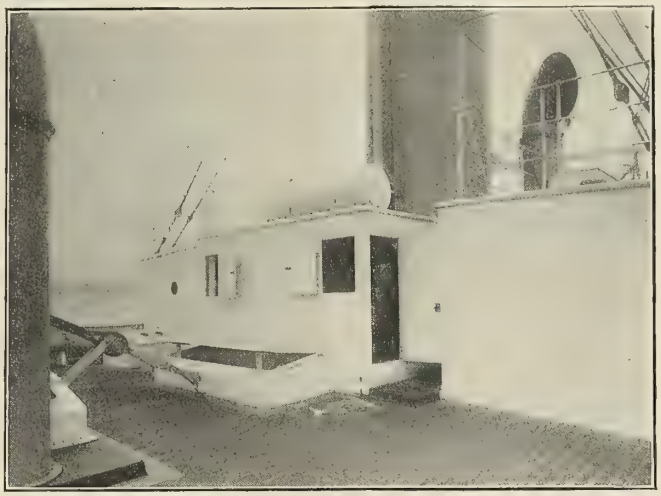


FIG. 4.—DECK HOUSE, WHERE FUMIGATING AND FIRE-EXTINGUISHING APPARATUS IS LOCATED

ship of the presence of rats, insects and disease germs, thus eliminating some of the most troublesome and dangerous hardships of the crew and ocean travelers.

As an illustration of the application of this apparatus to a modern steamship attention is called to the accompanying illustrations, which show the new American-Hawaiian steamship *Minnesotan,* one of the eight new vessels now being constructed for this company by the Maryland Steel Company to take advantage of traffic through the Panama Canal. All of these new ships are being equipped with this apparatus in the manner shown in Fig. 3. The gas machine is placed in a steel deckhouse, 8 feet by 13 feet, on the upper deck just abaft the smokestack; from this a main discharge pipe, 3 inches diameter, extends on the starboard side of the vessel forward and aft under the shelter deck. The main pipe leads to six manifolds, all of which are on the shelter deck, accessible at all times and securely protected, from which 2½-inch branch pipes extend to each deck in each hold of the vessel. All of the branch pipes lead to within 2 feet of the floor of the compartments. The vertical branch pipes are laid well up against the bulkheads, or against the face of the longitudinals or frames at the ship's side, and are securely protected with wood casings. All of the piping is of galvanized iron and fittings are avoided wherever possible, bends being substituted. While a separate pipe line for this gas is usually provided a combined gas and steam installation has been worked out in the case of the *Minnesotan,* but all pockets where condensed steam could collect have been eliminated, and there is always a fre flow for water to the drains provided, so as to keep the pipes as dry as possible for the gas. All of the branch lines are controlled by manifold valves, so that gas or steam may be forced into any compartment of the ship where it may be required, and, in addition to this, there are hose connections

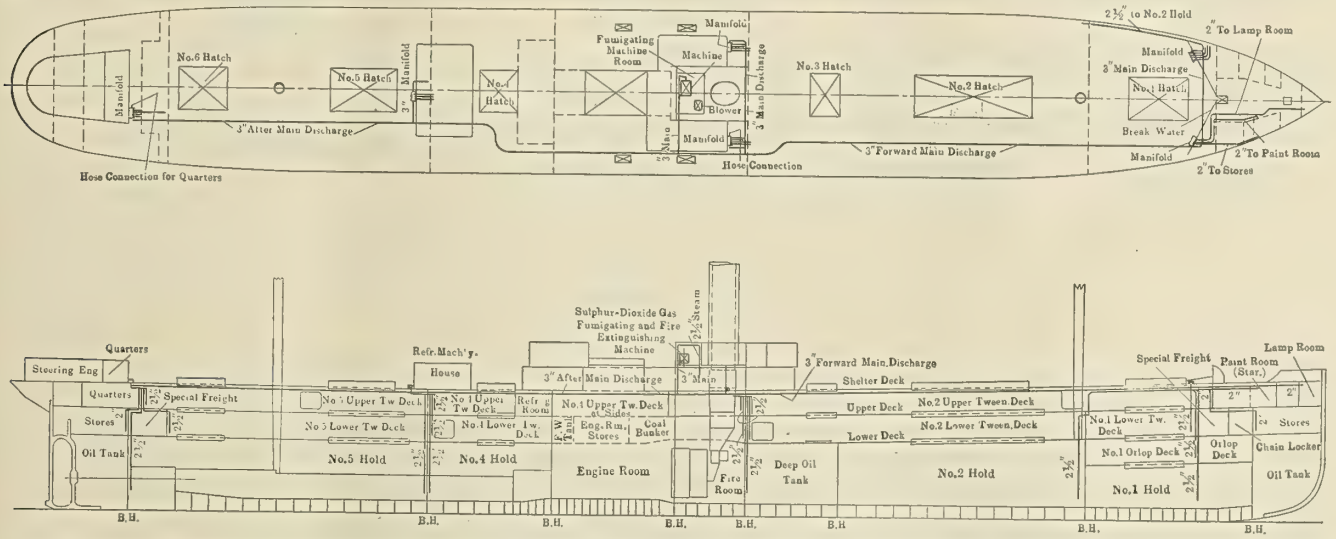


FIG. 3.—PROFILE AND SHELTER DECK PLAN OF THE MINNESOTAN, SHOWING ARRANGEMENT OF PIPING FOR THE FUMIGATING AND FIRE-EXTINGUISHING APPARATUS

One of the features of this equipment which will appeal to the engineer, is that the gas is not drawn from the machine through pumping apparatus, but that only air is pumped, and that into the furnace where the gas is generated; thus the gas is discharged under pressure, so that it does not come into contact with the blower outfit.

Besides the installations on the new American-Hawaiian steamships, the Panama Steamship Line and the Hamburg-American Steamship Company (Atlas Line service), and many others, use this apparatus. Smaller sets have also been supplied for shore use at Newark, N. J., Havana, Cuba, and elsewhere.

Communications of Interest from Practical Marine Engineers

Incidents Relating to the Design, Care and Handling of Marine Engines, Boilers and Auxiliaries; Breakdowns at Sea and Repairs

Attachment of Piston to Rod

That part of the interesting narrative, "Total Breakdown of High-Pressure Engine"—October issue—relating to the difficulty experienced in getting the piston off the rod, caused me to wonder why engine builders continue to fit pistons on tapered rods, when it is known to be extremely hard to get them off after they have been in service for some time. Of course, it is also well known that marine engines have to endure serious stresses and shocks at times, and therefore all the parts must be designed, built and assembled with that understanding. But pistons do break occasionally, or something else gives out which necessitates removing the piston from the rod, and then the trouble begins, as related in F. J. S. N's story, to which I refer.

The taper-fit idea is all right in principle, and would be all right in practice if the taper were of the *correct* inclination.

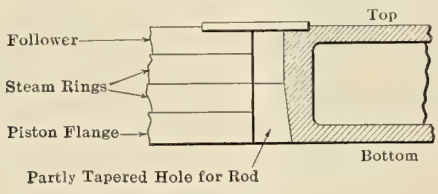


FIG. 1

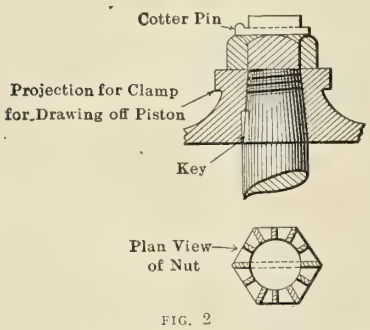


FIG. 2

If a taper is too "steep"—as shop parlance states it—it will not have any holding force, and dependence must be placed solely on the nut to secure the piston on the rod. On the other hand, if the taper has too little angle of inclination it may secure the piston so tightly to the rod that under conditions existing on board ship at sea it becomes almost impossible to get the piston separated from its rod. From the description given it would seem that the piston in the story was fitted on a taper that was of too little angle of inclination, and that probably was the reason the rod could be shoved further into the eye of the piston without splitting it. This could not have happened had the taper been too "steep."

Between the extremes of tapers alluded to there is one that serves the purpose of securing the piston to the rod, yet at the same time permits the piston being disengaged whenever and wherever it may be found necessary to do so. In order to find just what this taper is in any given case, it must first be found out what the angle of repose is for the metals of which both piston and rod are made. When the angle of repose is known, then a taper can be chosen that will not "stick" at a time when it is required to remove a piston under adverse circumstances, and under conditions when time is very valuable and must not be wasted in useless efforts.

Probably the majority of engine builders do consider the angle of repose feature when devising tapers for piston and other rods. But it is nothing uncommon to hear of just such trouble as recorded by your correspondent, and I wonder if in such cases the angle of taper was guessed at. In any case, the piston should be fitted so that it may be removed with ordinary means, and not as if it were never to be disconnected from its rod at all.

Pistons with eyes bored parallel and fitted on corresponding rods, as shown in the accompanying sketch, Fig. 3, have been used in stationary practice with satisfying results, and why not expect that they would also do in marine practice if properly designed otherwise? Here the piston is a sliding—not a loose—fit, and it is held securely against a shoulder on

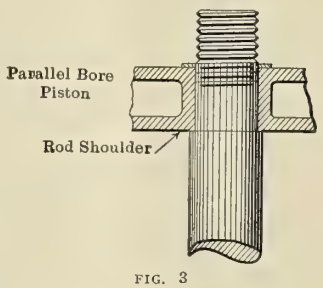


FIG. 3

the rod by a nut, as in the case of all pistons; the nut in turn is secured against slacking back by one of several devices well known. This makes a solid job, it is easily handled, and the piston can be taken off at any time without any trouble, as is frequently encountered with those represented in Figs. 1 and 2, when the tapers are not made in accordance with the angle of repose. What is the opinion of other engineers on this matter?

CHARLES J. MASON.

Scranton, Pa.

Efficieny of Turbines at Cruising Speed

With reference to the letter which appeared in a recent issue under the above heading, it may be of interest to trace the development of turbine arrangements with regard to their economy at cruising speeds.

The first turbine-driven vessels built (with the exception of the experimental *Turbinia*) were the torpedo boat destroyers *Viper* and *Cobra*. Although these vessels attained very high speeds it was quickly realized that their economy at low speeds left much to be desired. On account of this, in the next vessel built (H. M. torpedo boat destroyer *Velox*) a pair of small reciprocating engines were fitted in addition to the turbines to operate at cruising speeds, so that the arrangement adopted in the *Henley* is by no means novel.

In the case of the *Velox* the arrangement was as indicated in Fig. 1, there being four shafts with the high-pressure turbines on the outer shafts and the low-pressure and astern turbines on the inner. A triple-expansion engine was coupled to each inner shaft forward of the low-pressure turbine, and could be thrown in and out of gear by means of a clutch.

This arrangement has never been repeated in the British navy, subsequent improvements with installations of turbines only having rendered its adoption unnecessary.

In order to improve the efficiency of turbine-driven destroyers at cruising speeds the arrangement indicated in Fig. 2 was adopted, there being three shafts, the high-pressure turbine on the center shaft and the low-pressure and astern turbines on the wing shafts, while cruising turbines were added to operate in series with the main turbines, the high-pressure cruising turbine on the port shaft and the medium-pressure cruising turbine on the starboard shaft. These cruising turbines were cut out of action successively at increased speeds. This arrangement was just installed in the British torpedo boat destroyer *Eden*, and up to very recently has been the standard for British destroyers. It has been quite successful as regards cruising economy, probably its greatest drawback (and one common to all cruising turbines) being a liability to blading strips if the clearances are cut fine and the turbines are not carefully handled.

As regards battleships and cruisers the British Admiralty have abandoned the cruising turbine, and secured the desired efficiency at cruising speeds by adopting turbines of greater economy at all speeds, and by fitting additional rows of blades

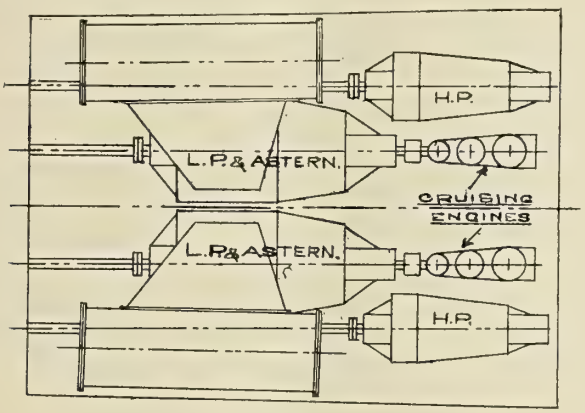


FIG. 1

(about twenty) at the initial steam end of the high-pressure turbine, this portion being by-passed at full speed. This arrangement has, the writer believes, been fitted to only one destroyer.

In the latest British torpedo boat destroyers, however, the three-shaft arrangement with cruising turbines has been definitely abandoned and twin screws adopted, each shaft being driven by a single turbine of the combined impulse-reaction type, with an astern turbine incorporated in the same casing. In this type of turbine the steam enters the nozzle boxes at 220-240 pounds per square inch, is expanded in the nozzles to about 70-80 pounds per square inch, passes through one velocity compounded wheel with four rows of moving blades, and thence through the remainder of the blading, which is of the usual Parsons reaction type. It is still too early for definite information as to the efficiency of this type of turbine, there being at present only the first two experimental vessels in service, but the fact that the British Admiralty have installed this system in their destroyers, and are also fitting it in scout cruisers, speaks for itself.

In addition several vessels have been fitted with twin-screw installations of turbines of the Curtis type. In these cases superheaters are used to obtain an efficiency equal to the Parsons system. Having thus traced the development of turbine installations in the British navy, as affecting efficiency at cruising speeds, we are in a position to consider further proposals.

In the first place one can only agree with Mr. Barry that an arrangement similar to that fitted in the *Henley* would be entirely unsuited to a battleship. Such an arrangement is only applicable to vessels of the destroyer type, where the rate of revolution is high, and the reciprocating engine can be made correspondingly small. The lower rate of revolution in a battleship would involve an engine of such dimensions as

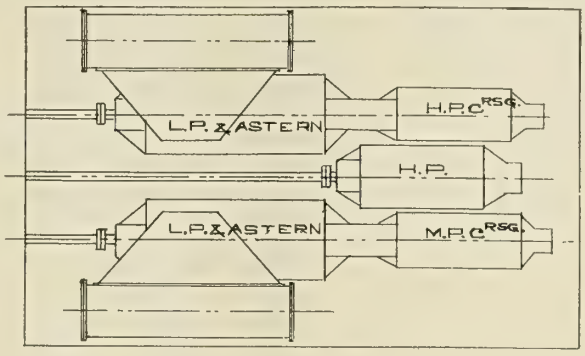


FIG. 2

to preclude its adoption. Mr. Barry has suggested the fitting of a clutch abaft the turbine, to be thrown out of gear and a two-to-one reduction gear substituted at cruising speeds. Mr. Barry points out that the power to be transmitted would be about 1,900 shaft-horsepower in the case of the battleship taken.

It would seem to the writer that some considerable experiment and trial would be necessary before an installation on such a scale could be reasonably attempted. A twin-screw torpedo boat destroyer would be a more suitable subject for experiment, as the power to be transmitted at cruising speeds would be about 500 shaft-horsepower. One disadvantage of this proposal is that the whole of the propeller thrust would have to be taken on the thrust block, the advantage of the steam balance of the Parsons turbine with its consequent freedom from thrust troubles being lost in such an installation, and it has been found that the provision of a block to take the whole of the thrust at the high revolutions of turbine machinery is somewhat difficult.

Mr. Barry's second proposal, to gear a small high-speed

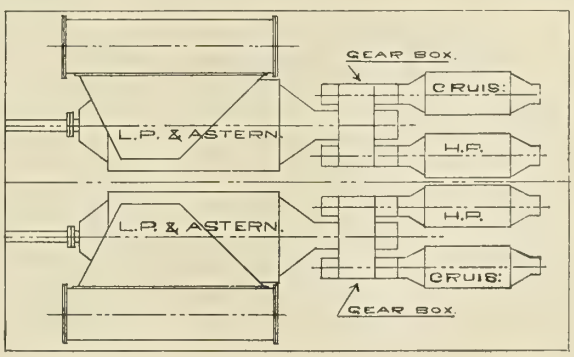


FIG. 3

turbine or reciprocating engine to the shafting forward of the main turbines and exhausting to them, appears to have more to recommend it. We may take it that if gearing is to be fitted the reciprocating engine need not be considered. Mr. Barry must not, however, imagine that this proposal is original, as Messrs. Parsons (who undoubtedly possess the largest experience on the subject) have proposed similar arrangements for some considerable time, and have at the present moment two destroyers completing on the Clyde for the British navy, these vessels being fitted with a system of

geared turbines which embodies their ideas, the arrangement being indicated in the sketch Fig. 3.

There are two main shafts, which run at about 600 revolutions per minute, and directly coupled to these shafts are the low-pressure turbines, in which are incorporated the astern turbines. Forward of each low-pressure turbine and connected to the main shaft through double helical gearing is a cruising turbine and a high-pressure turbine, the reduction ratio being such that with for 600 revolutions per minute of the main shafts the cruising turbine runs at about 3,000 revolutions per minute and the high-pressure turbine at 2,000. With this arrangement the safety of the installation is independent of the gearing, while the gearing admits the adoption of very small, high-speed, economical turbines to aid the efficiency at cruising speeds.

One of these vessels has already run trials on which a speed of about 30½ knots has been attained, the gearing being very free from noise except for a loud hum. The trials at cruising speeds indicate a remarkable degree of economy, for whereas the consumption of oil on the 24-hour trial at cruising speed has been (for the standard British torpedo boat destroyers) in the neighborhood of 18½ tons, the adoption of this geared arrangement has reduced it to about 14½ tons.

It would appear that an arrangement of this type is a more rational method of applying gearing, more especially in the initial stages of its application, as not only is the propulsion of the ship independent of a breakdown of the gearing, but in addition the thrust is equalized by the steam balance in the usual way.

The latest arrangement for securing economy at cruising speeds is the adoption of Diesel oil engines for use at low powers. These are thrown out of gear at higher speeds. With oil-fired vessels this would enable the steam arrangements generally to be almost entirely shut down under cruising conditions, so that a great increase in economy should result. The writer understands that a torpedo boat destroyer is being built for the British Admiralty with machinery arranged on the above lines, and the results of her trials will be looked forward to with great interest. Gearing.

The Diesel Electric Drive in the Tynemount

In your issue of October, 1912, on page 396, a notice appears regarding the Canadian canal vessel *Tynemount,* now building in England to the order of the Montreal Transportation Company, and which is to be fitted with oil electric machinery.

The proposed arrangement is one which was developed by me in co-operation with Mr. H. A. Mavor, as long ago as 1909, in order to enable the Diesel engine to be used for propulsion without interfering in any way with the usual type of propeller which is so essential for successful propulsion in the Canadian canal trade. In other words, it has been found that the Diesel engine, being naturally of a high-speed character, is best run at revolutions which cannot be reconciled with the slow-speed, coarse pitched type of propeller best suited to the full-formed canal vessel of the lake type for propulsion. Further, the go ahead and go astern motions required in any propulsion directly coupled to the propeller in negotiating the very numerous locks in the Welland and St. Lawrence channels are quite fatal to any type of internal combustion engine requiring compressed air for starting and reversing. In such rapidly alternating motions the cycle of operation on which the success of the Diesel engine depends is completely upset, the fuel injected into the cylinders is not properly burned and trouble incidentally results.

In the *Tynemount* the Diesel engines, coupled to their alternators, will run continuously in one direction only and under governor control furnishing power to the propeller motor keyed to the propeller shaft just ahead of the thrust block, and this motor will deal with the necessary speed changes and reverse being easily controlled by a very simple switching mechanism.

Very satisfactory results have recently been obtained in Schenectady in the plant of the General Electric Company, in a 6,000 horsepower outfit for the collier *Jupiter,* in which a Curtis turbine of the high-speed type was used to drive the alternator.

The scope for electric transmission in marine propulsion is clearly established and the combination Diesel electric installation in the *Tynemount* has created great interest. The *Tynemount* was ordered in England by the Electric Marine Propulsion Company, Ltd., and sold to the Montreal Transportation Company. It is being built under my supervision and to plans and specifications proposed and approved by my firm. John Reid

Montreal, Canada.

The Draftsman in Shipbuilding

The extracts from the paper under the above heading in your August issue provoke some thoughts about ship accommodation generally. The paper has much interest, but the sentences causing reflection are as follows:

"Spaces allotted to ———— living quarters are so small that much time is required after a contract is obtained to arrange them in a workmanlike design."

"Arranging and rearranging the berths and lockers in a space only half large enough."

Whosever the fault, the fact remains that in freight ships especially the accommodation for officers and engineers (not to mention the firemen and sailors) is usually cramped, badly lighted and infernally inconvenient.

The writer once asked for a transfer from a 10-knot freighter mainly on account of the lack of accommodation and convenience. He was duly informed that he was better off where he was, certainly than in the steamship ————, the third and fourth engineers in her had to practice gymnastic feats every time on their way to the engine room.

Conditions of life ashore in the way of accommodation are receiving considerable attention just now. Even the immoral speculative builder is now putting up quite small houses with some regard to domestic convenience. The United States has led the world in the provision for workmen in factories of conveniences in the way of lockers, washing and dining facilities. It is now an axiom of manufacturing that, other things being equal, the capable workman discriminates against a works lacking facilities and comfort. Large firms vie with each other in their care of employees; in short, the industrial conscience is slowly but surely awakening to the fact that money spent in this wise is a paying investment.

With regard to ships, and these not always freighters, elementary comfort for the crew is not studied in the manner it might be. There is no question but that space on a vessel is valuable, but certain anomalies exist and at little extra cost a great deal may be done.

Take any freighter running outward with coal to the Mediterranean and home with grain to the Continent under the British flag. It will be found that the skipper, naturally, has a good room, but the officers are debarred from the so-called saloon except at meals. This "saloon" is the only reasonable place on the vessel, but is the captain's private lounge. Sea etiquette (a survival from past ages) holds good in this particular to-day.

A berth 6 feet cube with one 8-inch portlight is in most instances considered accommodation for two certificated officers. Sleeping space occupies 65 feet cube, a locker athwartships, on which it is impossible to lie full length, and a

small chest of four drawers completes the outfit except for a fold-up washing basin. Considering that outside this room there is only the deck, I submit that the accommodation is inadequate for two men of their rank and position.

Engineers are a trifle better off. Not, however, in size of room, because of the small mess room in which it is possible to foregather. It was an engineer, however, who stated that to turn over in his bunk he had first to get out and open the door of his room.

A vessel (oil tank) in which the writer sailed, doing Western Ocean passages, had the rudder post through an unusually large messroom. The engineers, being berthed aft in what otherwise would have been vacant space, had really roomy quarters. The rudder post passed through the floor, and had no gland or stuffing-box to keep the water out. The existing bush was worn ½ inch slack, and you can't monkey with a rudder in mid-Atlantic. The condition of affairs in mid-winter in heavy weather can be easily imagined. To add to the beauty of the circumstances, the only store for provisions was under the messroom. A foot of water rolling in and out of our berths, a fountain playing every time the vessel sat in the water, combined with a tired-out mess steward vainly endeavoring to stem the tide, were not comfortable conditions any way you look at it. The particular ship was a very hard-run engine room job—always in trouble below. Two short trips were an excessive allowance for me, combined with a chief whom the job was rapidly fitting for an asylum.

Again, take the officers' accommodation. There is a bath room provided, but usually this again is the skipper's perquisite. I have been in ships where the mates had no chance of a satisfactory bath in spite of the provision of a bath room aft. The skipper held the key of the door.

The engineers' bath room, being unprovided with any water facility, is often kept as a store for packing—the engineers washing down below on the back platform. The provision of hot and cold water to the bath could be easily arranged. Even so a chief suffering from the not unusual malady of coal fever might prohibit its use on the ground of economy.

This all applies to freighters, where proper accommodation is easily arranged. Passenger vessels are better provided in spite of the increased value of space therein. The officers and engineers then share in the superior accommodation provided for the passengers.

I have been East through the tropics to China in a freighter where the engineers' accommodation was formed out of a portion of the 'tween deck bunker. Ventilation was impossible in any adequate sense. Each room had a 36-inch long cowl ventilator projecting from the main deck. The engine room superstructure cut off the wind from these ventilators if not blowing from the same side. Boiler room ventilators are carried up clear of the superstructure; but then boilers cost money and so does coal, and you cannot burn the latter without draft. Engineers can, however, be much more easily replaced.

Why not an adequate bath room amidships, available to all officers and engineers, situated close to the engine room; it could easily be arranged even if cold water were led in and simply heated with a steam jet. This would be little trouble when the ship is designed. A couple of hot spray baths for the crew would not cost a fortune, either.

It is rather a pity, and in this I agree with the author of the paper, that ship draftsmen do not get sea experience. In my humble opinion, while I fully appreciate the importance of their calling, six months, say, in the engine room would alter some of the poor accommodation now afloat in future ships.

One ship designer on the Northeast coast is known to me who holds British certificates of competency as engineer, and he has certainly improved matters in this direction for the inhabitants of the freighters turned out at the yard where he is employed. He informs me that it takes some scheming, but is not impossible to do, even where he encroaches upon the size of the sacred "saloon" to do it.

There is importance in this question to owners. The junior engineers and officers take considerable responsibility. The actual work in the engine room is entirely carried through by the juniors. It is desirable, therefore, that the most capable and brainy men on the market should be secured. Times and conditions of life are changing and ideas of comfort are becoming more considered. If the accommodation and conditions in a ship are good, a junior will think more than once before making a shift. The actual cost of providing decent accommodation in a new ship is trifling considered as a percentage of total cost, and such provision is worth while. The type of man known as a "one ship bird of passage" has little stake in your interests, "Mr. Owner." The type of man you are likely to get under modern conditions in such ships as I indicate are not desirable persons. No complaint reaches your ears; the good man simply gets out and you are the loser without knowing it.

In conclusion, I submit that reasonable space, fittings, ventilation and provision for personal cleanliness for officers and engineers, a comfortable, roomy, light forecastle and provision for personal cleanliness for the crew, sanitary in accordance with modern notions, are elementary matters costing little but which mean much. It should not be necessary to point this out. The best ships get the best men, and it is as well to forestall legislation on such matters as these.

London, England. A. L. Haas.

Steamboating on the Amazon

The steamer *Curityba,* one of fourteen American stern-wheel river boats, 125 feet long by 26 feet beam, 3 feet 6 inches depth of hold, built by James Rees & Sons Company, Pittsburg, Pa., and shipped in knock-down form to Para, Brazil, for service on the Amazon, left Para Aug. 23 for Rio Madeira to Porto Velho. On this trip the steamer traveled up several small tributaries en route from Para to Itacoatiara, the mouth of the Madeira, returning from Porto Velho to Manaos and then to Alto Purus and Acre Rios, carrying a rubber commission sent out from Europe. On leaving Para the boat was drawing about 32 inches of water at the head, and had coal, stores, etc., on board aggregating about 110 tons. She could have carried safely in quiet water 30 or 35 tons more. The average speed up the Amazon and Madeira until she reached very strong water was close to 8 miles an hour, which was reduced to 5 or 6 miles an hour over riffles. The coal consumption was, roughly, 5 tons per day. The boat handled very well in spite of the fact that the pilots and captain were natives, unfamiliar with this type of boat and with the methods of river boating in vogue on the Western rivers in the United States. The *Curityba* left Itacoatiara 24 hours behind another vessel, the *Francisco Salles,* operated on this route, and passed her twice on the river, beating her into Porto Velho by about four hours. The distance between the points named is about 750 miles. The *Francisco Salles* is a much larger boat, being 180 feet long by 33 feet beam, molded. She is a stern-wheel steamer, with cross-compound engines 18 inches and 38 inches diameter by 5 feet stroke, whereas the *Curityba* has high-pressure engines 9 inches diameter, 48 inches stroke. The usefulness of the stern-wheel boats on this river is evident, but it is a serious problem to find men who are capable of operating the boats to the best advantage.

Para, Brazil. An Ex-Mississippi River Pilot.

Review of Important Marine Articles in the Engineering Press

Diesel Engines for Naval Purposes.—By Lieut. A. K. Atkins, U. S. N. This is one of the most satisfactory contributions to the literature of Diesel engines in many months. Uninfluenced by the idea of gain, and without the prejudice of too long experience with steam, Lieut. Atkins weighs the merits of the Diesel engine for naval service, recognizing that steam is near the top of its efficiency and reliability curve, and that progress is pointing the way for this new motor to accomplish much more for speed, steaming radius and fuel-carrying capacity than is at present possible with any means. After reviewing the essentials in the development of types of Diesel engine practice, the author makes comparisons of motor service with examples of naval steam engine performance. The achievements of the former are now sufficient for such a comparison on every point of service. A résumé of reasons for and against the oil engine is carefully drawn up, which is a very sane statement of the situation. Too lengthy to be given here, even in condensed form, it is sufficient to say that for a careful summing up of the matter to the present time we have not seen it excelled. The disadvantages mentioned in adopting the Diesel engine are the need of frequent cylinder cleaning, possible rise in the price of oil fuel, danger in carrying fuel oil in bulk and the high cost of the installation. These are, of course, matters calling for careful consideration, but, with such quondam difficulties as reliability, continuous operation for long periods of time and maneuvering qualities unmentioned as serious objections to the service, the way looks bright indeed for the rapid adoption of the Diesel motor. 6,000 words.—*The United States Naval Institute Proceedings,* June.

Four-Cylinder, Four-Cycle, Diesel Engines.—An article describing engines built by Mr. Franco Tosi, of Legnano. The first-mentioned is a four-cylinder, four-cycle Diesel engine of 600 horsepower installed in the engineering section of the Turin Exhibition, where it contributes to the electrical supply. The cylinders are 21 inches diameter and 30.3-inch strake and the engine runs at 150 revolutions per minute. The second engine referred to is a four-cylinder, two-cycle marine Diesel engine of 500 horsepower when running at 170 revolutions. There are two independent scavenging pumps which are run at a less piston speed than that of the main engine. Connected to these and above them is a three-stage air compressor. Other auxiliary pumps are described in some detail. Cycle of operations necessary in starting, reversing and operating the engine are given in full, describing the action of the controlling mechanism. A third type of engine described is that fitted in an Italian torpedo boat. The propelling machinery consists of three sets of 6-cylinder, 2-cycle single acting Diesel engines of 800 shaft-horsepower each when running at their full speed of 330 revolutions. The engines are placed in separate compartments arranged longiudinally in the ship and are coupled to their propeller shafts by friction couplings. When running at cruising speeds of 14.5 knots or less, the center engine alone is used, the others being uncoupled and the propellers running free. In this condition, 240 shaft horsepower is developed at 170 revolutions per minute, the fuel oil consumption being .706 pounds per shaft horsepower hour, taking into account a 15 percent loss of power due to drag of the two side propellers. The radius of action at cruising speed with 15 tons of oil fuel on board is said to be 2,820 nautical miles. For running at full speed, 29 knots, the three engines develop 2,400 shaft horsepower with a fuel consumption of .496 pounds per shaft horsepower hour. Power can be increased to 3,000 shaft horsepower for half an hour, when the speed obtained is 31 knots. 4,200 words. Well illustrated by drawings and photographs.—*Engineering,* May 24.

The Langen & Wolf Diesel Engines.—The firm of Langen & Wolf, of Milan, builds Diesel engines for ships' auxiliaries in all sizes up to 600 horsepower, and up to the present its output amounts to 20,000 horsepower. The engines built are on the lines of the usual land type of engine, and are of the four-cycle, trunk piston type, with cylinder jackets cast with the A-frame supports. The air compressors are of the two-stage horizontal type, driven off the forward end of the crankshaft. The standard 400-horsepower engines have cylinders 440 millimeters diameter and 480 millimeters stroke, and give their power at a normal speed of 250 revolutions per minute, although they are capable of substantial overload for short periods. The pistons are made in two parts like the Tosi engines recently described and reviewed in these columns. The description of the engines goes into some detail. Illustrated. 1,800 words.—*The Engineer,* July 26.

The Japanese Battleship Kawachi.—The battleships *Kawachi* (now in commission) and *Settsu* (completing for sea) are the first all-big-gun ships of the single-caliber type for the Japanese navy. These ships have been built at Kure and Yokosuka, respectively, and have been building for somewhat over three years. The *Kawachi* is fitted with Curtis turbines on three shafts and the *Settsu* with Parsons turbines on four shafts, both ships having a designed horsepower of 25,500 and 20.5 knots speed. Mijabara boilers are used for both. Normal coal supply is 900 tons, with 2,500 tons for a maximum. The armament consists of twelve 12-inch, ten 6-inch and twelve 4.7-inch guns and five torpedo tubes. The main battery is placed in six turrets, arranged after the German *Helgoland* design. The armor consists of a waterline belt 12 inches thick amidships, tapering to 5 inches at the ends. Above this is a 9-inch belt, and above this a 6-inch belt reaching to the upper deck. Turrets are 9 inches thick. A 2½-inch protective deck supplements the side armor. The displacement is 20,750 tons. Illustrated with photographs and sketch plan. 3,000 words.—*Engineering,* July 26.

New Graving Dock, Belfast—Mechanical Plant and General Appliances.—By W. Redfern Kelley, engineer-in-chief to the Belfast Harbor Commissioners. The new graving dock at Belfast is the only one of its kind which will receive the *Olympic.* It is unusual not only for its great capacity but for its modern and complete equipment. The over-all dimensions are: Length, 901 feet; breadth, coping to coping, 128 feet; depth of water on keel blocks at mean high water, 32 feet 9 inches. The paper is not intended to deal with the general construction of the graving dock proper, but rather with those items of mechanical plant, such as the pumping installation, hydraulic system, boilers, capstans, caisson, culvert sluices, etc. The full capacity of the graving dock is about 21,000,000 gallons of water, and the duty of the pumping plant is to discharge this in 100 minutes. This is done by three centrifugal pumps, each having two suction pipes 42 inches diameter, driven by three cross-compound engines 22-38 by 20-inch stroke, running at 125 revolutions per minute and developing approximately 750 indicated horsepower on 160 pounds of steam. The boiler plant is composed of four Babcock & Wilcox watertube marine type boilers, each having 3,590 square feet of heating surface and 105 square feet of grate surface. Each boiler is fitted with superheater, delivering steam of 100 degrees superheat to the engines. The description continues to good length, and includes the other important

items of the mechanical plant. Well illustrated. 8,000 words. —*Transactions of the Institution of Mechanical Engineers,* July.

Notes Upon a Marine Engine.—By Mr. W. Veysey Lang. An unusual contribution upon a very ordinary subject. Mr. Lang writes for designers from the viewpoint of operators, suggesting and urging the adoption of what he considers best practice. This paper deals with the subject of main engines alone, boilers and auxiliaries being left for separate treatment. Some of the subjects discussed are size of engines, size of cylinders, clearances, cylinder liners, piston rings, shafting, thrusts, stern tubes, platforms, ladders, handrails, splash plates, air pumps, valves, rods and packing. Among other things he favors reduction of clearances, now commonly made unnecessarily large, the use of liners in all high and middle-pressure cylinders, the increase of boiler power rather than of engine size for a given job, a volute piston ring spring with the ring of softer metal than the liner, solid thrust carriage with heavy horseshoes bolted down on both sides, capable of slight adjustments at the ends, a thermometer in the thrust, interchangeability of parts and standardization of sizes wherever possible, and particularly with regard to rods and stems and their packing. There is included a list of proper spare gear which should be furnished, much of which, being now left to owners' discretion, is withheld. Some surprise and considerable discussion were aroused over the preference for the D-slide valve in all cylinders of a triple engine. In speaking of condensers, attention was called to the necessity of ample steam spaces between the rows of tubes, and an example was cited where the vacuum was increased from 23 inches to 25 and 26 inches by taking out tubes, fitting of steam baffles, and better arrangement of flow of circulating water. 18,500 words.—*Transactions Institute of Marine Engineers,* July.

Dahl Oil-Burning System.—The advantages of mechanical atomizing in oil burners for marine service are great enough to insure their early development. The Dahl system of mechanical atomizers, patents of which are controlled by the Union Iron Works, of San Francisco, has been installed on a large number of ships and has proven very satisfactory, even with the difficulties encountered in burning the heavier oils. The main advantage of mechanical atomizer over the steam jet is the saving in fresh water required; over the air jet, the saving of an air compressor which must be positive in action, and the necessary piping. The Dahl burners are simple, have few parts, and clogging of the tips is guarded against by three separate strainers at different points in the system. These burners have been run thirty-six hours under the most adverse conditions without becoming clogged or requiring cleaning. Very few changes are necessary in boilers having Howden draft. The essentials of the system are a pump, heater and burner, although a reserve pump and heater are always fitted. There are no moving parts to the system except the pump, and its operation is without noise. The temperature recommended for fuel is from 180 to 200 degrees, and the pressure should be about 60 pounds per square inch. Complete instructions for operating are included, together with a table of ships fitted with Dahl burners. Fully illustrated. 1,900 words.—*Marine Review,* August.

British Steamship Centenary—The Comet and Her Creators. —That the shipbuilding industry is only a century old would scarcely seem possible viewed in the light of the present achievements. That such is the case, however, is shown by the celebration recently held on the River Clyde, where relics of the first steamboats were shown and a grand processional display of shipping was held, which was taken part in by warships of several types as well as representatives of the merchant fleets. The article herein reviewed does not refer to the centenary celebration but to the early history of the industry itself, endeavoring, as is stated, to avoid traversing the oft-trodden ground of a sequent and detailed story of Bell and the *Comet,* and to emphasize less known and perhaps debatable points of the subject. Following out this purpose some very interesting facts regarding the building of the *Comet* and other vessels immediately following this pioneer are given. Not only is the mere sequence of events shown but the attitude of the builders, who believed, even then, that at some time the steamboat would be known on all waters. The article is well illustrated with photographs of the *Comet,* her engines and the builders, and a drawing of the lines of the vessel. 4,800 words.—*The Marine Engineer and Naval Architect,* August.

Wire Ropes for Lifting Appliances and Some Conditions that Affect Their Durability.—By Daniel Adamson. The question of durability of parts of mechanical structures is a subject apparently not given the attention by the authorities that their strength receives, for while one generally has the choice of several formulæ for the latter consideration, little of definite knowledge is available for the former subject. In the subject of wire ropes especially does this author find such a lack. This contribution to the Institution of Mechanical Engineers is the report of a study of the subject made to put into definite shape all available information on the subject. A number of sources are quoted, but the most satisfactory seems to be a set of experiments made to determine the best form of cable to be used in the building of the Forth Bridge by Mr. A. S. Biggart in 1890. From the data of these tests and conclusions from others, some quite practicable results are obtained. Elements of the subject considered are size of pulley, number of bends and reverses, size of wires in cable, and whether cable is oiled. Tables are drawn up and curves drawn showing relative life of rope with each of these elements varying. That oiling the cable increases its life very much, that reverses are detrimental to endurance, and even that several bends are not conducive to lasting qualities are some of the conclusions reached. Illustrated with sketches of various arrangements of ropes in lifting appliances. 3,800 words.—*Transactions of the Institution of Mechanical Engineers,* July.

Ten-Horsepower "Monobloc" Marine Oil Engine.—A detailed description of a small marine oil engine made by Messrs. Boulton & Paul, Norwich, with all four cylinders cast in one piece. In size 3 inches diameter and having 5-inch stroke, they have the exhaust pipe and water-jacket around it also cast *en bloc.* To insure getting the cores cleanly away, a long inspection door is provided in the water-jacket of the exhaust pipe. Water-jackets around the cylinders are large, to insure ample cooling. The description is carried to some detail. Illustrated by drawings and photograph. 480 words.—*Engineering,* August 16.

Shipbuilding in Russia.—In order to promote the national shipbuilding industry the Russian Government has prepared a scheme for developing the merchant marine of Russia simultaneously with the establishment of a new navy in that country. It is proposed to grant a bounty of from 65 to 105 roubles per ton on all ocean-going ships built in Russian yards, while a further payment of one rouble and a half per pood is to be made on parts of machinery constructed for Russian-built vessels. It is also intended to encourage the investment of native capital in national shipbuilding undertakings by extending the legal proportion of the loan capital to the ordinary share capital in the sense that the loan capital without any regard to the share capital may be increased to an unlimited extent. It is already possible for the shipbuilders to obtain loans from the State at a low rate of interest of 3.6 percent for a period of twenty years, and to the extent of 40 percent of the cost of constructing the hulls of vessels and 30 percent of the cost of the machinery, and this practice is to be continued in future. The scheme also provides for the admission free

of duty of foreign-built ships which may be acquired by Russian shipping companies. 840 words.—*The Engineer,* September 27.

Suction Between Vessels.—By Prof. A. H. Gibson and J. Hannay Thompson. The experiments described in this paper were carried out in the Firth of Tay to obtain the magnitude and range of action of the forces involved in case of suction or inter-action between passing vessels. Two screw-propelled vessels were used. One, the steam yacht *Princess Louise,* was 88.5 feet in length, 13 feet beam, 5.66 feet mean draft, displacing approximately 96 tons. The second was a motor-driven launch, 29.33 feet long and 6.75 feet beam. Each was driven by a single screw. The experiments were divided into two distinct sets. In the first the vessels were maneuvered until on sensibly parallel courses heading for the same distant object, their lateral distances apart and speeds being varied in different experiments. The relative positions of the two boats were fixed by observations taken every fifteen seconds during each run. Also, at the same intervals readings were taken from a series of pressure boxes fixed to the hull of the smaller boat from which the turning moments and lateral forces acting on the hull of the boat were computed. The second series of experiments was carried out to measure the helm angle required to maintain the course of the smaller when in the vicinity of the larger vessel. The general conclusions from the experiments were as follows: The greater the difference between the speeds of the vessels the smaller is the risk of collision, since such a difference reduces the time during which the mutual forces are operative, such an effect being much more marked when the smaller vessel is the faster, but if the larger vessel is the faster, and particularly if her speed is accelerated while passing the smaller, the attractive forces are increased to an extent which partially, and in some cases entirely, counterbalances the effect of a reduction in the time during which the vessels are in dangerous proximity. It follows that any attempt of the larger vessel to draw ahead of the smaller by increasing her speed greatly increases the risk of collision. On the whole, the results of the trials show that under unfavorable circumstances inter-action is a very real danger to navigation even in deep and open waters. With vessels of the relative sizes adopted for the experiments, if the possibility of inter-action is realized from the very first, and if all initial swerve is prevented by an early application of the helm, there would appear to be little danger even at lateral distances so small as one-half the length of the smaller vessel, but if this possibility is not realized and such a swerve has once been initiated, a much greater helm angle is necessary to control the vessel, and, failing immediate control, collision occurs within a comparatively few seconds even from astonishingly great distances. The importance of this fact is more readily grasped when it is realized that with a vessel of, say, 300 feet in length passing a vessel of, say, 900 feet in length, the forces of inter-action have to be reckoned with even when the vessels are 1,000 feet apart laterally, which would be ordinarily considered to be giving the larger vessel a very wide and safe berth.—*Transactions of the British Association,* September, 1912.

Recent Progress in Diesel Engines.—A table is given in which are included thirty-two motor vessels now under construction or under contract, all of which are of large size, the power in none being less than 400 horsepower, and, except in four, it is over 1,000 horsepower. Twenty-six of these vessels have twin screws, although all of those equipped with Carels engines are single-screw boats. Eighteen of the vessels have four-cycle engines and fourteen are fitted with two-cycle engines. Of the double-acting engines apparently only two are on order except for naval purposes. The only marked deviation from ordinary design is found in the Junkers engine, which will soon be given a fair trial. 2,700 words.—*The Motor Ship and Motor Boat,* September 26.

The Launch of H. M. S. Audacious.—The super-dreadnought *Audacious,* a ship of 23,000 tons, 596 feet long over all, 555 feet long between perpendiculars with a beam of 89 feet and a draft of 27 feet 6 inches, was recently launched from the Birkenhead yard of Messrs. Cammell, Laird & Company, Ltd. The ship will be fitted with Parsons turbines to develop 31,000 shaft-horsepower for a speed of 21 knots. She is to be fitted with Yarrow boilers. Her main armament consists of five pairs of 13.5-inch guns, and she will have twenty smaller weapons and three torpedo tubes. Her broadside armor will consist of a belt 12 inches thick amidships, reduced by steps to 4 inches at the bow and stern. The heavy guns will be protected by 11-inch armor. 550 words.—*Engineering,* September 20.

The Price of Diesel Engines.—On acocunt of the fact that practically every marine Diesel engine built is something quite new, and that the engine has been produced only at the expense of a vast amount of experimental work, it is to be expected that the cost of the engine at present should be higher than might even be expected from the amount of high-class workmanship required in the production of such a complicated engine. The rapid progress of the two-cycle type of engine is noticeable, and it is expected that this type will be materially cheaper than the four-cycle engine. In the case of engines for naval vessels, the high cost is not an insurmountable barrier. On the whole it seems to be a conservative view to anticipate that within four or five years the difference in the cost of steamships and motor vessels will be practically negligible, the hull costing a little less in the case of a motor ship and the machinery slightly more. 1,200 words.—*The Motor Ship and Motor Boat,* September 19.

Marine Propulsion by Electric Transmission.—By Henry A. Mavor. This paper describes all the notable installations of electrical drive for ship propulsion, including those supplied by the General Electric Company for the United States naval collier *Jupiter* and the Chicago fireboat *Graeme Stewart,* which have already been fully described in the technical press. The last installation is that on an oil-engined tank barge, which is now being built in England for Canadian service. The present arrangement of this ship gives an increase of about 250 tons in the carrying capacity as compared with a steam equipment. The vessel is 256 feet long over all, 250 feet long between perpendiculars, 42 feet 6 inches breadth extreme, 19 feet depth, molded, designed for a speed of 9 knots. On a 14-foot mean draft in fresh water it is estimated that the vessel will carry about 2,400 tons deadweight of cargo, fuel, fresh water and stores. Two steam boilers are provided for working the deck equipment, steering gear and electric light and for the supply of heat for the living quarters. The main machinery equipment comprises two units, each consisting of an oil engine, dynamo and a winding on the propeller motor. The engines are of the high-speed type, which has been developed by Messrs. Mirrless, Birkerton & Day, with cylinders 12 inches diameter, 13½ inches stroke; revolutions per minute, 400. The electric equipment consists of two three-phase generators, giving about 235 kilowatt-amperes at 500 volts alternating. The generators have six and eight poles, respectively, giving frequences of 20 and 26.6 per second. Connected to the shaft of each generator is an exciter, which in normal working gives about 30 amperes at 100 volts, but is capable of a considerable overload. A single three-phase motor developing 500 shaft-horsepower is coupled direct to the propeller shaft. The machinery is controlled by a simple gear, which can be operated from either the bridge or the engine room as desired. Illustrated. 4,000 words.—*Transactions of the British Association,* September, 1912.

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In devoting our present issue to the subject of shallow draft boats we are adhering to a custom inaugurated two years ago, which, on account of the interest aroused in modern transportation on inland waterways, seems worthy of further consideration. To the old-time river boatman who has witnessed the decline of steamboating on the great Western rivers of the United States from its flourishing condition in pioneer days to its present lethargy, and to the railway enthusiast who has been so eminently successful in diverting traffic from the rivers, it no doubt seems visionary to look for success in the rehabilitation of inland waterway commerce. An interesting article on another page of this issue, reprinted from one of the leading railway journals, sets forth conclusively the principal reasons for this decline, and those who are conversant with the history of steamboating on the Mississippi will recognize the truth of these statements. A more scientific study of certain phases of the subject can be found in a series of articles on the "Lakes-to-the-Gulf Deep Waterway," published in recent issues of the *Journal of Political Economy;* but, notwithstanding the discouraging outlook for river transportation thus brought forth, it must be admitted that to-day the Western rivers offer the same facilities for navigation that were available in former times, and, in some respects, vastly improved facilities. On the other hand, the type of equipment has not kept pace with the rapid development of improvements in shipbuilding and marine engineering that are manifest in ocean traffic, nor has the problem of developing adequate terminals for river conditions been thoroughly solved. It is in these directions that opportunities should be sought for restoring inland waterway commerce to a position of economic usefulness.

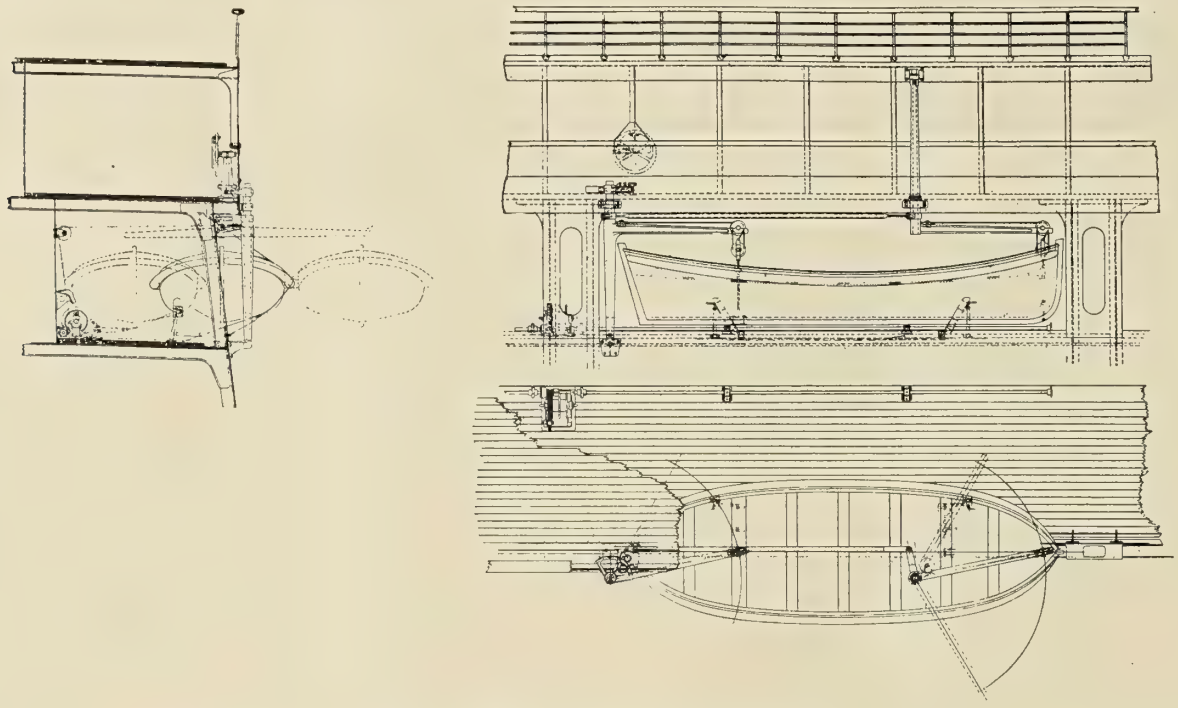
According to the returns compiled by Lloyd's Register of Shipping, which, excluding warships, take into account only those vessels actually under construction, there were building in the United Kingdom at the close of the quarter ended September 30, 1912, five hundred and five vessels, of 1,846,829 tons gross. This is about 73,000 tons more than was in hand at the end of the last quarter, and exceeds by 400,000 the tonnage building in September a year ago. These figures are the highest ever recorded in Lloyd's returns, and give a good indication of the remarkable expansion of the shipbuilding industry in the United Kingdom during recent years. Until 1911 the amount of shipbuilding under construction at any one time had barely exceeded 1,400,000 gross tons, although this figure had been reached in three previous years—first in 1898, again in 1901, and finally in 1906. On each of these occasions, however, the volume of tonnage rapidly diminished after this figure had been reached. On the other hand, in 1911 the volume of tonnage under construction, after reaching this figure, continued to increase at an almost uniform rate until the present remarkable figures were attained, establishing a period of prosperity in the British shipbuilding industry never before realized; and with the prospect of continued activity in this direction, unless serious labor troubles or other disturbances arise, the English shipbuilders can look forward with confidence to the coming year.

In the United States the condition of the shipbuilding industry is also encouraging, as we have noted in previous issues. For the quarter ended September 30, 1912, the Bureau of Navigation reported 485 sailing, steam and unrigged vessels of 80,281 gross tons built and officially numbered, while during the corresponding quarter last year only 462 vessels, aggregating 76,048 gross tons, were built. Besides the increase in tonnage there is another marked change in these reports. Last year 50 percent of the shipbuilding was on the Great Lakes, while less than 40 percent was on the Atlantic coast. This year, however, 60 percent of the shipbuilding was on the Atlantic coast, while less than 22 percent was on the Great Lakes. Thus, with the coast yards engaged to normal capacity and with reasonable assurance that the Lake yards will shortly recover from a temporary depression, there is every reason to anticipate a successful year in the American shipyards.

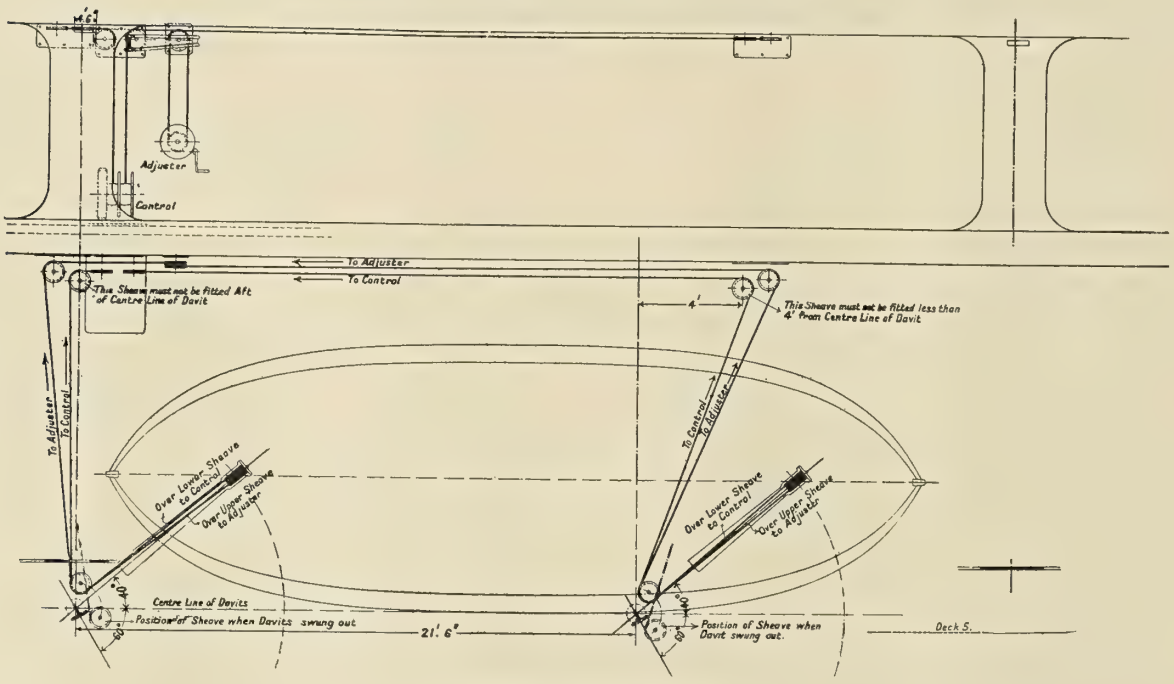
Improved Engineering Specialties for the Marine Field

Welin Boat Davits for the Imperator

In a paper read before the British Association at Dundee in September, Axel Welin, the inventor of the quadrant davit, described the recent improvements in lifeboats and their manipulation on board ship. His conclusions as to the best type of life-saving gear are that a properly constructed lifeboat, placed under efficient launching gear, is the best and safest appliance obtainable, and that a high degree of reliability is in these matters of far greater importance than a possible saving of a few seconds. Attention is called to a method of grouping lifeboats which offers several advantages. Along the extreme edge of the deck is placed an ordinary lifeboat (with or without a motor), directly attached to the lowering tackle of a double quadrant davit, and immediately inboard, stowed one above the other, are two "decked" lifeboats of the type (see page 252, June issue) invented by Capt. A. P. Lundin, president of the Welin Marine Equipment Company, Long Island City, N. Y. In this arrangement three boats are handled by a single pair of davits, the only difficulty, the fouling of the tackle, being overcome by the use of a non-toppling block, which prevents this. The radical departure brought forth in this paper, however, is a new type



GENERAL ARRANGEMENT OF WELIN LOWER-DECK DAVIT

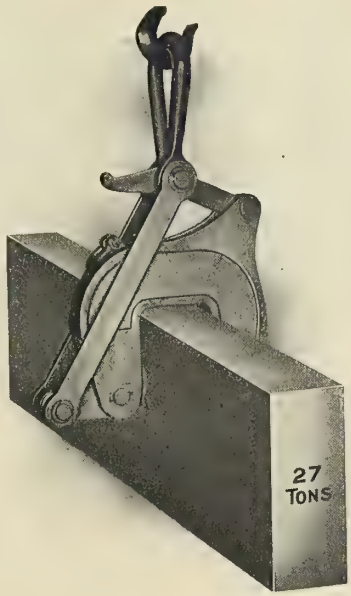

Adjuster
Control
To Adjuster
To Control
This Sheave must not be fitted Aft of Centre Line of Davit
This Sheave must not be fitted less than 4' from Centre Line of Davit
4'
To Adjuster
To Control
To Control
To Adjuster
Over Lower Sheave to Control
Over Upper Sheave to Adjuster
Over Lower Sheave to Control
Over Upper Sheave to Adjuster
Centre Line of Davits
Position of Sheave when Davits swung out
21' 6"
Position of Sheave when Davit swung out.
Deck S.

CONTROL OF LOWER-DECK DAVIT

of the Welin davit adapted for the handling of lifeboats placed between the lower and upper promenade decks, thus enabling the carrying on large ships of a greater number of lifeboats, and in such a manner that the boats are launched from a less height than would be necessary if all the boats were stowed on the boat deck. As an example of this arrangement the installation of Welin davits on the new Hamburg-American steamship *Imperator* is described. A model of the arrangement of lifeboats on the *Imperator* was also exhibited by Mr. Welin recently on the floor of the Maritime Exchange, New York. On the *Imperator* the boat deck lies some 70 feet above the waterline. Placing the boats on the lower decks permits launching of the boats in from 40 to 50 seconds, and gives the boats a far better chance of reaching the water safely than if launched from the lofty boat deck. A special adjusting gear permits lowering the boats at any desired angle, as may be required by the trim of the vessel itself. The hoisting is done by means of electrically-driven fore-and-aft transmission shafts, provided with friction drives, each boat being handled quite independently of the others. The largest lifeboats are capable of accommodating seventy-six people, and weigh, fully loaded, approximately 8 tons each. The principal mechanical feature of the arrangement is that one, at least, of the two davits is supported above the boat instead of socketing it at a point below, as is usual. The general arrangement can be seen from the illustrations. The two davits are connected by a coupling rod attached to short cranks on the davits proper, so that the arms stand at every point parallel to one another. The boat travels parallel with its own axis, and the tackles always remain in a vertical position.

Positive Patent Lifting Clamp

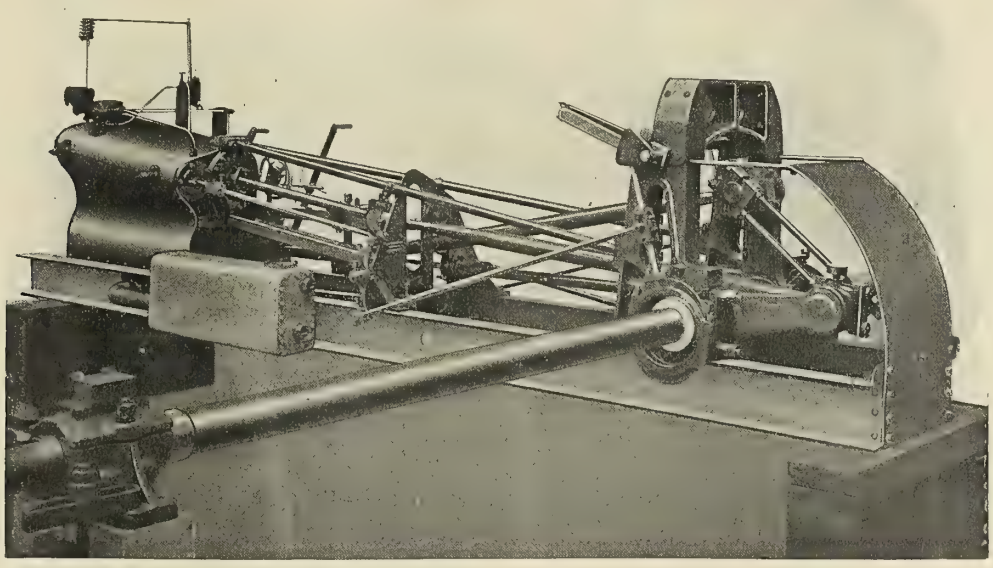
A lifting clamp made both for lifting and for hauling in any capacities ranging from ½ to 50 tons; for handling plates, beams and structural shapes for use in steel works, rolling mills, boiler and tank shops, iron and brass foundry annealing



furnaces; for railroad and steamship companies in loading and discharging, and, in fact, for all purposes where a positive and reliable clamp is required, avoiding the danger of swings, ropes, etc., besides effecting a large saving in time and labor, has been placed on the market in England by the Weldless Chains, Ltd., Coatbridge, Gartsherrie, and in America by William E. Volz, 126 Liberty street, New York. The clamp is made in various sizes, the one illustrated being supplied for lifting armor plates 9 inches thick and weighing 27 tons. The clamps are made from mild steel castings and forgings with a tempered steel serrated piece dovetailed to the side of the gap frame. The gripping cam is also tempered on the working face. It is claimed that the grip is instantaneous and positive, and the heavier the load the firmer the hold.

Side Paddle Wheel Engines for Shallow Draft Steamers

The illustration shows the arrangement of a light, compact engine which is manufactured by W. Sisson & Company, Gloucester, for use on side paddle-wheel shallow draft steamers. The particular engine illustrated is a set of compound, non-condensing engines, 8½ inches and 13½ inches diameter by 36 inches stroke, using steam at 150 pounds gage pressure and operating at 45 revolutions per minute. The engines are erected on two longitudinal deep angles, channels or I-joists of rolled section for bolting down to the hull of the vessel, thus procuring a rigid structure.



A Crane for Flat River Boats

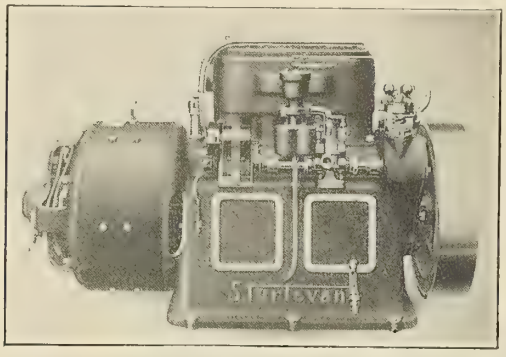
The Browning Engineering Company, Cleveland, Ohio, has adapted some of its well-known locomotive type cranes to

special uses for loading and unloading flat river boats. The illustration shows a typical installation of such a crane, which is placed directly on the boat and used not only for dredging but also for unloading material from the boat.

Sturtevant Gasolene (Petrol) Electric Generating Sets for Marine Use

The law which has recently gone into effect requiring that every vessel shall be equipped with an auxiliary generating set, situated upon the deck of the ship and supplying electric current for the operation of wireless apparatus has created a sudden demand for such a generating set and a demand that must be met immediately. The appearance of the new Sturtevant gasolene (petrol) electric generating set manufactured by the B. F. Structural Company, Hyde Park, Mass., is, therefore, very opportune, especially as it is well adapted to this line of work.

These sets consist of Sturtevant gasolene (petrol) engines direct connected to Sturtevant electric generators. The two are mounted upon the same cast-iron base and are so well



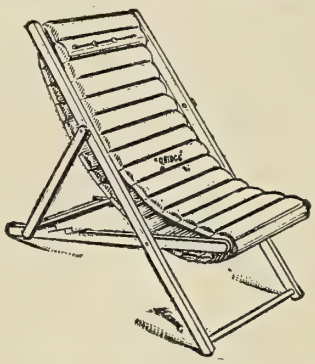
balanced that it is simply necessary to secure the sets to the deck of the ship to prevent shifting in high seas. They are always ready for duty as an auxiliary or for continuous duty as the prime mover. The simplicity of construction and dependability of operation insure proper results whenever they are called upon for service. This reliability of service is a characteristic Sturtevant quality found especially in these, and the steam engine generating sets which the B. F. Sturtevant Company have manufactured for the United States Navy for so many years. The same type of generator is used in these gasolene (petrol) sets as is used with Sturtevant steam-driven combinations.

Besides the use as wireless outfit apparatus, these sets will give economical and satisfactory results as lighting plants for ships of all kinds, either as auxiliary or main lighting plants. They are independent of accident in the engine room if placed on the deck, and insure illumination under all circumstances. No storage battery is necessary with these sets, as a particularly sensitive governor controls the speed so closely that wide variations of load cause no fluctuation of the voltage or flickering of the light. The lubrication is forced and automatic.

The engine is of the vertical multicylinder automobile type, operating on the four-stroke cycle principle and water cooled. Four and six cylinder combinations are used, according to size, the present sizes being 5, 10 and 15 kilowatts.

Life-Saving Deck Chair

Leoline Edwards, 81 St. Margaret's Road, Twickenham, has placed on the market a folding steamer chair which is capable of supporting the weight of two persons in the water. The frame of the chair is firmly built, and in place of the ordinary single canvas there is a backing of double green



waterproof canvas laced at the ends. Across this canvas are sewn divisions equally all around, and these divisions are separately filled either with granulated cork, kapok, koma, reindeer hair, or other buoyant material as desired, and sewn securely in, giving a most restful, soft, springy seat. The whole of the backing of this chair can be pulled around like a roller towel, thus presenting a dry seat even in wet weather.

Technical Publications

Beeson's Marine Directory of the Northwestern Lakes. By Harvey C. Beeson. Size, 6¾ by 9½ inches. Pages, 270. Numerous illustrations. Chicago, 1912: Harvey C. Beeson. Price, $5.00.

As this is the twenty-sixth annual number of this directory it needs no introduction to marine people. Its contents this year are even more varied than heretofore. The numerous tables of American and Canadian steam vessels on the Lakes, gas-engined vessels, records of engines and boilers, officers of Lake marine associations, etc., have all been brought up to date, and the tables are supplemented by a number of interesting articles on important marine happenings during the past year.

Centrifugal Pumping Machinery. By Carl George de Laval. Size, 6 by 9¼ inches. Pages, 184. Illustrations, 159. New York, 1912: The McGraw-Hill Book Company. Price, $3.00 net.

The general subject of centrifugal pumping machinery has been treated briefly in many standard textbooks on hydraulic machinery, but few of these treatises give sufficient information to aid a designer. This book has, therefore, been prepared with the idea of supplying accurate and definite information which can be used in actual design. The author has had an extensive experience in this line of work, and the data which he gives are based upon the results obtained with such installations as have been turned out by the company with which he is connected. The book is, therefore, a record of facts and it can be considered as authoritative. The book is by no means elementary, although the underlying principles are given, so that no mistake could be made in their application.

The Principles of Heating. By William G. Snow. Size, 5¾ by 9 inches. Pages, 224. Illustrations, 60. New York, 1912: David Williams Company. Price, $2.00.

This is a practical and comprehensive treatise on applied theory in heating. The contents of the book are largely made up of a collection of articles by the author which have been published in *The Metal Worker, Plumber and Steam Fitter.* These contributions have been supplemented by reprints of articles relating to heating prepared by other writers. The opening chapters deal with the heating power of fuels, boilers and combination heaters; gas, oil and electricity versus coal; heat driven off by direct radiators and coils; the loss of heat by transmission; heating equivalents, etc., following which are chapters on capacities of piping for hot-water heating, the flow of steam in pipes, and then the different systems of heating are taken up, including steam, hot water, central heating plants and mill heating. There are a great number of charts and tables in the book, but these are interspersed in the text as they apply to the subject under immediate discussion.

The Rule of the Road at Sea and Precautionary Aids to Mariners. By Daniel H. Hayne. Second edition. Size, 5½ by 8 inches. Pages, 165. Baltimore, Md., 1912: The Co-operative Publishing Company. Price, $3.25

This manual was issued in 1897 for private distribution, but on account of the interest evoked by its publication, the book has been revised, enlarged and issued in its present form. The author is a member of the Baltimore Bar, and for this reason is familiar with the Admiralty law and important cases which have been settled by Admiralty courts, thus enabling him to bring before the reader in condensed form a great mass of useful information as to the conduct of navigation at sea. The purpose of the manual is to emphasize the necessity of closer co-operation between navigators by direct address to the personal side of the problem, and thus secure a more prompt and uniform compliance with the rules and regulations designed to prevent marine collisions. Heretofore it has been quite difficult for a navigator to keep abreast of prevailing decisions of the courts, as some of the rules are silent on important points which must be fully understood to effectually apply them. So, too, it has been observed that there is no systematic method of bringing to the attention of each individual on shipboard the precautionary measures required in his particular line of duty. The use of this manual, therefore, gives the responsible person an opportunity to familiarize himself with his duties in the matter of navigation and bring him to recognize his responsibilities. It is of particular value to motor or power boat owners and operators and yachtsmen, who largely through ignorance are daily taking unnecessary risks in navigating their vessels. Part I. of the manual refers briefly to practical precautions relating to the rules of the road and to certain well-considered court-made rules defining good seamanship, which are applied as rigidly as the navigation rules. Part II. presents some of the more practical elements in ship conduct and discipline and precautions in handling the vessel and its equipment, to which prudent navigators have attached much importance and to which they owe their immunity from accident.

The Romance of Submarine Engineering. By Thomas W. Corbin. Pages, 316. 38 Great Russell street, London, W. C. Seeley Service & Company, Ltd.

A fascinating subject is covered by Mr. Thomas Corbin in his "Romance of Submarine Engineering." This work is the latest addition to the admirable series of the library of romance published by Seeley Service & Company, Ltd. Some fifty-four diagrams and photographs are included, which add considerably to the interest of the volume. We remember two previous volumes by Mr. Corbin upon engineering and mechanical invention, written in non-technical language, and the present volume is not at all behind these two extremely well-written books. He has aimed at giving in popular language descriptions of how submarine boats are constructed, the recovery of sunken treasure, the building of breakwaters and docks, and many other feats of engineering beneath the surface of the water. The volume gives in clear language an account of the men, their tools and the work associated with engineering under water. The subject is one that lends itself to being dealt with in a fascinating manner, and Mr. Corbin has written a volume each chapter of which is full of information. The language employed is simple and the style excellent, and the subject is treated with enthusiasm.

Heroes of Science. By Charles R. Gibson. Pages, 344. 38 Great Russell street, London, W. C. Seeley Service & Company, Ltd. Price, 5/-.

An interesting addition has been made to the "Heroes of the World" series of books published by Seeley Service & Company, Ltd.—a series which has secured a well-merited reputation. The new volume, which is excellently illustrated, is devoted to heroes of science, and the author, Mr. C. R. Gibson, F. R. S. E., has given a description of the lives of some of the most outstanding men of science in an easy and readable form. Mr. Gibson has already achieved considerable success in his several other works on scientific subjects written from a popular standpoint, and the new volume enhances that reputation, as it shows all the merits of its predecessors. Some fifty-three men of science are mentioned in the work, and they are introduced in chronological order, covering a period from 1214 to 1912, or Roger Bacon to Lord Lister. The author states that he has gone to considerable trouble to authenticate all the information he gives as far as possible, and has not sacrificed accuracy for the sake of sensation or effect. No subject is more fascinating than science, and no literature more readable than biography. We heartily welcome, therefore, this work, which is an admirable combination of the two.

Kings' Cutters and Smugglers—1700-1858. By E. Keble Chatterton. 8½ by 5½ inches. 425 pages. London, 1912: George Allen & Company, Ltd., 44-45 Rathbone Place. Price, 7s. 6d. net.

The halo of romance which surrounds stories of smugglers and kings' revenue cutters never fades even in our later and more prosaic days. We therefore welcome the excellent volume which Mr. E. Keble Chatterton has written dealing with the romantic history of kings' cutters and smugglers during the century and a half extending from 1700-1858. As we have pointed out before, Mr. Chatterton, who is a prolific writer, knows his subject thoroughly, has a capital style, and is a keen yachtsman. The present volume, he tells us, represents an effort to look at the exploits of old-time smugglers as they actually were, and not as a novelist likes to think they might have occurred. The book is none the less interesting for being written from this standpoint. The value of the book is increased by reason of the appendices, in which Mr. Chatterton has included some interesting historical data, the collection of which has, we learn, involved a great deal of labor. Full particulars are included regarding the dimensions and details of a revenue cutter's construction, her tonnage, guns, etc., the number of her crew, and the names and dates of the fleets of cutters employed. The illustrations, which number thirty-three, are all excellent and include some taken from old prints.

Personal

William T. Donnelly, consulting engineer, New York City, has been appointed engineer of the State Commission on Steamship Terminals at New London, Conn.

William Gardner, naval architect, has formed a co-partnership with Mr. Frederick M. Hoyt and Mr. Phillip Leventhal, under the firm name of William Gardner & Company, naval architects, engineers and yacht brokers, with offices at No. 1 Broadway, New York.

Selected Marine Patents

The publication in this column of a patent specification does not necessarily imply editorial commendation.

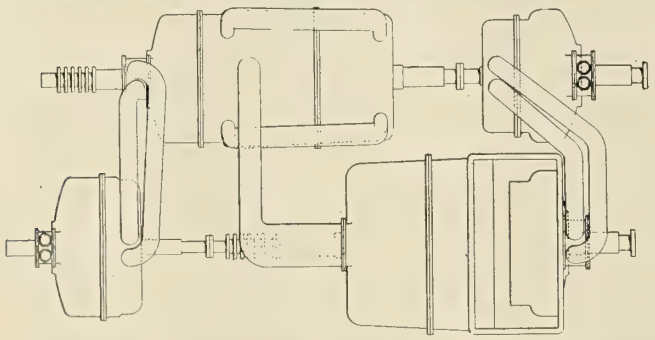
American patents compiled by Delbert H. Decker, Esq., registered patent attorney, Loan & Trust Building, Washington, D. C.

1,027,720. MARINE RAILWAY. ROBERT O. GALLINGER, OF SEATTLE, WASHINGTON.

Claim 2.—The combination with railway tracks at opposite sides of a body of water, and a railway track submerged in said body of water, of a wheeled carriage mounted for travel upon the last-named track, a railway track upon said carriage, power means for effecting the travel of the same between the terminals of the first-named tracks, means for automatically securing the carriage at the ends of its travel, and means operated from a car for disengaging the carriage securing means. Four claims.

1,027,698. MARINE STEAM TURBINE. CHARLES G. CURTIS, OF NEW YORK, N. Y.

Claim 2.—In a marine steam turbine, the combination with two propeller shafts, of high and low pressure turbine elements on one shaft,



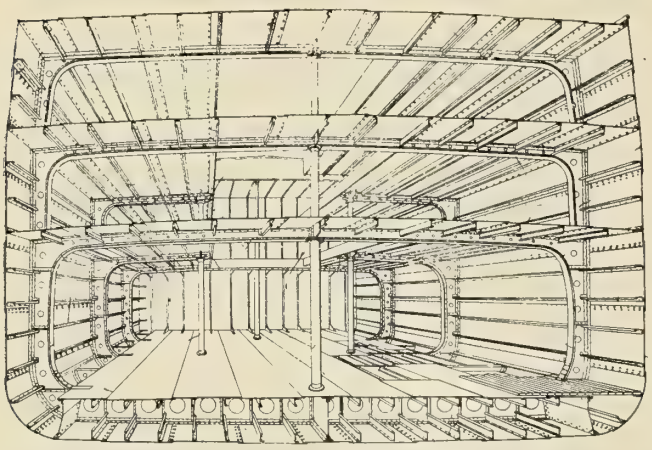
an intermediate pressure turbine element on the other shaft, the latter having reversed drum stages. Twelve claims.

1,025,930. VESSEL-RAISING DEVICE. BYRON J. SPENCER, OF FORT STEVENS, OREGON.

Claim.—A sling for raising ships and the like comprising cables adapted to be disposed against the frames of a ship, U-shaped anchoring members having their ends extended through said frames and impinging said cables thereagainst, rings secured to the free ends of said cables, and horizontally arranged cables secured to said rings. One claim.

1,029,546. CONSTRUCTION OF FLOATING VESSELS. JOSEPH WILLIAM ISHERWOOD, OF MIDDLESBROUGH, ENGLAND.

Claim 1.—A vessel in its main body portion provided with consecu-



tive transverse frames individually a plurality of times stronger and spaced a plurality of times farther apart than has heretofore been customary in the same class of vessel, said frames extending to the shell or deck plating of the vessel, said vessel being also provided in said portion thereof with longitudinal frames which, as compared with the transverse frames, are individually weak and very closely spaced, and which also extend to the shell or deck plating of the vessel. Twelve claims.

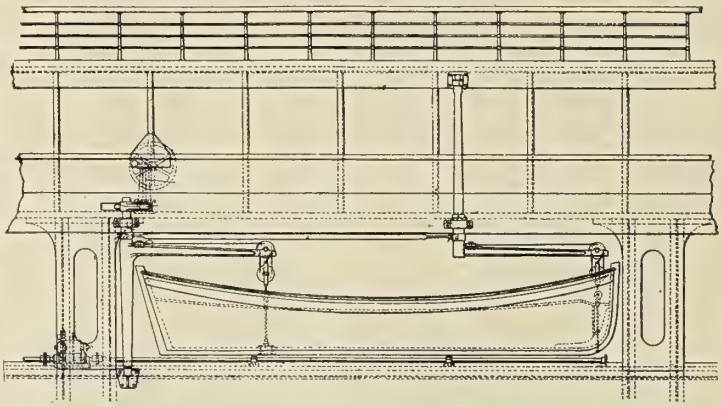
1,033,810. DIVING-GEAR FOR TORPEDOES. FRANK M. LEAVITT, OF SMITHTOWN, NEW YORK, ASSIGNOR TO E. W. BLISS COMPANY, OF BROOKLYN, NEW YORK, A CORPORATION OF WEST VIRGINIA.

Claim 1.—In an automobile torpedo the combination with a depth steering mechanism comprising a pendulum, a hydrostat, and a steering engine controlled by either of them, of means for preventing the transmission to said engine of the rearward or lagging movement of the pendulum during the acceleration of the torpedo at launching, such means adapted to leave the steering engine under control of the hydrostat. Eight claims.

British patents compiled by G. E. Redfern & Company, chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 21 Southampton Building, W. C., London.

14,511. BOAT-LOWERING APPARATUS. A. WELIN, LONDON.

This apparatus is constructed so that the life-boat may be carried on any of the lower decks. The arrangement allows the boat to cross the axis of one davit and to swing inboard to such a position that none of



it projects beyond the side. This end is attained by supporting one davit from above. The boat is thus always parallel to the ship's side and the falls hang vertically.

16,305. SIGNALING APPARATUS FOR INDICATING THE APPEARANCE AND DISAPPEARANCE OF WATER IN SHIPS. N. PODGOURSKY, ST. PETERSBURG.

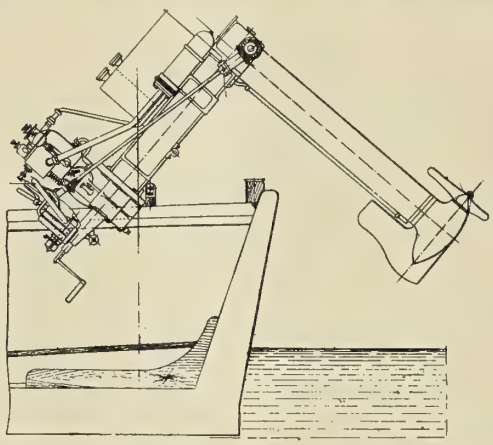
By this invention a float is mounted on the spindle of a commutator in a hermetically closed casing, or to a like casing which rotates and contains a pendulum contact for closing or opening an eletric circuit when the casing rotates, the commutator being switched into the general circuit or into the circuit of a separate battery, so that when the float rises owing to the inflow of water and the spindle is turned the circuit is automatically closed, and operates a signal.

22,684. APPARATUS FOR STEERING TORPEDOES. L. OCENASEK, Prague.

By this invention the movements of the torpedo after leaving the dispatch station are controlled by means of a beam of light projected from the station. The torpedo proper is carried by a vessel having steering and disengaging gear. The control is effected by means of corresponding turning forks at the station and on the vessel. The vibrations of a station fork are used, through an electro-magnet, to vary the current flow in the light circuit so that the intensity of the beam is varied intermittently. The beam is received by a selenium cell on the vessel placed in an electric circuit thereof, and whose varying intensity causes the corresponding fork to vibrate and mechanically close the circuit of a motor for operating, say, the disengaging screw which relieves the torpedo.

28,201. UNDER INTERNATIONAL CONVENTION. DETACHABLE PROPELLING INSTALLATIONS FOR SHIPS AND BOATS. SOCIETE G. DUCASSOU AND COMPAGNIE, PARIS.

This installation is pivoted near the stern of a boat, and has a dipper arm carrying the screw and its block, the latter being integral with a



rudder blade. This construction allows of steering when the screw is not working. The block can be turned by the steering gear through the entire circle, whilst the whole installation may be oscillated about the deck pivots to bring the screw up for inspection, for avoiding weeds, etc.

28,197. APPARATUS FOR SEIZING SUBMERGED BODIES, ETC. A. LAUMET, PARIS.

Hooks or arms are pivoted to a platform and are kept open by a second platform suspended from the lowering rope and engaging pins on the hooks. The device is lowered until a feeler rests upon the object to be raised, and so allows the platform to descend and release the arms, which then turn downwars and clasp the object, which may then be raised by means of the rope. The arms may be prevented from opening by a ring lowered around them by means of a wire sling and auxiliary rope. Modifications are descrbed.